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REGIONAL ENTERITIS

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NO SUBJECT in surgery has created more discussion and interest in so short a period as has regional ileitis, as it was first designated by Crohn (10) and his associates in 1932. Although only 4 years have elapsed since their article, twenty-seven treatises dealing with this disease have appeared in American medical literature. The subject has aroused the interest of surgeons, internists, roentgenologists, pathologists, and research students. As it has not previously been discussed before this society, opportunity is taken to present our cases with a summary of those of other members. To the 114 cases which have appeared in the American literature, there are added 4 in our series and 64 from the members of the society, making a total of 182 cases. I wish to pay recognition to the excellent article appearing on this subject in SURGERY, GYNECOLOGY AND OBSTETRICS, by one of our members, Dr. Karl A. Meyer.

As one becomes familiar with its rather characteristic symptoms, he is inclined to conjecture how many such cases he may have overlooked prior to 1932. Even now, undoubtedly many innocent appendices are being removed while the real source of the discomfort is overlooked. If more need be said as to the inadequacy of the formerly popular button hole incision, it might be urged that even the remote possibility of ileitis demands an adequate abdominal exploration when conditions permit it. Regional enteritis, mesenteric lymphadenitis, a diseased Meckel's diverticulum, and lesions of the gall bladder and pelvis are but a few of the pathological entities which, through inadequate exposure, may escape the surgeon's eye.

Mesenteric lymphadenitis is undoubtedly akin to regional enteritis, both possibly being due to low grade infections of the lymphatic system. Both are baffling as to diagnosis and etiology. The classical paper of Leonard Freeman first focused our attention on that then mysterious entity, mesenteric lymphadenitis, now so well known that occasionally it may be diagnosed prior to operation. This condition also should not be overlooked at operation, for such patients may likewise continue to complain of abdominal distress for months following an appendectomy. It behooves the surgeon to explain this to relatives at time of operation. Everett Coleman has told us that fortunately in the majority of these cases recovery eventually takes place.

Probably both lesions are due to a diseased lymphatic system. Lymphadenitis is characteristic of the former and may occur in the latter. In one of our cases, the most striking appearance when the abdomen was opened

From the Jackson Clinic.
Presented before the Western Surgical Society at Kansas City, December 11, 1936.

was that of enormous mesenteric glands in the mesentery of the terminal ileum. Both conditions are common in young adults; acute exacerbations and spontaneous cure may occur in either; a chronic form is characteristic of each.

Reichert and Mathes, in a recent article, first suggested the possible etiological factor in regional enteritis. Working with dogs by injecting irritating and sclerosing materials into the mesenteric and subserol lymphatic vessels, they produced sclerosis and thrombosis of the lymphatics, which led to a chronic lymphedema of the intestinal wall. These investigators believe that the two dominant features are a low grade infection with a concomitant chronic lymphedema.

In 1935 Felsen traced 11 acute and 11 chronic cases of distal ileitis to bacillary dysentery. Crohn reported only 1 positive agglutination against dysentery organisms in ileitis. Paulson believes that Crohn's claims of a distinct entity cannot be maintained. Probstein and Gruenfeld believe that the greater frequency of this lesion in the distal ileum may be due to stagnation at the ileocecal valve and the greater abundance of lymphatic tissue there than at other bowel segments, a factor favoring bacterial absorption.

There has been a tendency on the part of some to interpret the acute edematous swelling of the ileum not infrequently observed in acute appendicitis, as that of acute regional enteritis. Such cases have not been included.

The typical symptoms and the characteristic appearance of regional enteritis are well known due to the classical description by Crohn, Ginzburg, and Oppenheimer. Excellent dissertations on this subject by Mixter; Clute; Connell; Brown, Bargen, and Weber; Erb and Farmer; Kantor; Homans; Haas; Bockus; and Lee are also available. These reports have stimulated interest in, but have added little to the original description of the disease. Harris, Bell, and Brunn, in 1933, reported a somewhat similar condition involving the jejunum, an observation also noted in our series, as well as in others. Early in 1934, Colp described an identical process affecting the ileum and cecum, and then Brown, Bargen, and Weber reported 18 cases involving the ileum, cecum, and part of the ascending colon. These findings were confirmed by Phillips and by Ropke of Germany. Crohn and Rosenah (11) have recently called attention to the fact that their previous conception of the disease as occurring only in the ileum was incorrect; that it may be found not only on other parts of the small bowel, but in the large intestine as well. For this reason, the term "regional enteritis," as first suggested by Brown, seems more appropriate.

In their original paper, Crohn, Ginzburg and Oppenheimer maintained that the entity they were describing was distinct from the group of so called "benign granulomas" previously reported in the medical literature. This group included all chronic inflammatory lesions of both the large and small intestines, the etiology of which was unknown. Tietze, who reviewed all the literature on this subject in 1920, described no case resembling that of regional ileitis. In 1923 Moschcowitz and Wilensky reported in detail 1 case of a disease involving the terminal ileum suggestive of ileitis. Crohn grouped the cases into four clinical types representing progressive stages:

Group 1. The symptoms of this group simulate those of acute intra-abdominal inflammation, appendicitis in particular. Pain and tenderness in the right lower quadrant, accompanied by cramps, fever, and leucocytosis occur, and there may or may not be a palpable mass. Operation reveals a greatly thickened and reddened terminal ileum which has a tendency to bleed. The mesentery is edematous, with enlarged hyperplastic glands. The appendix may be involved by contiguity, but it shows no mucosal inflammation.

Group 2. Symptoms suggestive of ulcerative colitis occur in the second stage with diarrhea and cramp-like abdominal pain, and occasionally blood and mucus are found in the stool. Severe anemia may develop, with marked weight loss, malaise, and slight fever.

Group 3. The stenotic stage follows the ulcerative phase. As a result of the extreme thickening of the intestinal wall, the lumen of the bowel gradually becomes constricted. The healing of the mucosal ulcerations tends to bring about an obliteration. This is most marked in the region of the ileocecal valve. The symptoms are those of partial obstruc-

Fig. 1. Specimen of the terminal ileum, the cecum, and part of the ascending colon.

Fig. 2. Resected portion of the ileum.

tion of the small intestine. A mass is usually palpable. Violent cramps, occasional attacks of vomiting, and constipation occur.

Group 4. In this stage multiple fistulas are formed that may open either internally or externally through the abdominal wall. Roentgenological examination may reveal these fistulas, which persist and resist surgical measures at closure, unless the bowel is resected.

The symptoms depend somewhat upon the location of the lesion; the higher the constriction the more pronounced are the symptoms of a high intestinal obstruction. The extent and the severity of the lesion determine the predominant symptoms. The most typical cases I have observed are those in young adults suffering from acute colic-like abdominal pains usually occurring 1 to 2 hours after eating, with nausea and vomiting. The pain in these cases is intermittent and yet severe enough to require morphine. Visible peristalsis may be observed. The age range has been from 16 to 56 years.

Determination of the diagnosis depends upon the roentgenologist. In the early stage the roentgenogram may reveal no characteristic lesion but as the chronic, stenotic form develops a filling defect in the terminal ileum with a mild ileal stasis and distention proximal to the defect appears. In cases with still greater stenosis, the lumen shows merely as a fine line of barium, described by Kantor as the "string sign." He has also called attention to three other significant roentgenological findings, namely: a filling defect just proximal to the cecum; an abnormality in contour of the last filled loop of ileum; and dilatation of ileac loops just proximal to the lesion.

Various conditions must be considered in the differential diagnosis, such as acute appendicitis, mesenteric lymphadenitis, ileocecal tuberculosis, intestinal obstruction, ulcerative colitis, neoplasm, and actinomycosis.

Pathological findings vary according to the stage of the disease. The involved section of

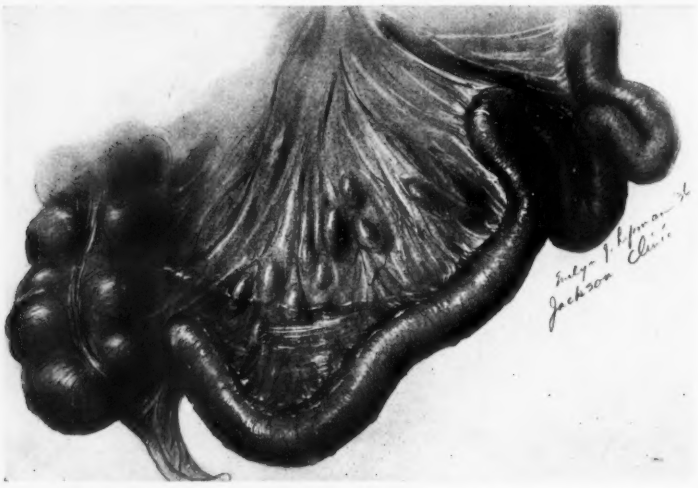

Fig. 3. Regional enteritis showing marked involvement of the terminal ileum with enlarged mesenteric glands.

bowel, together with its mesentery, is greatly thickened and doughy, like a soggy hose. In the acute stages, the diseased intestine may appear edematous and hyperemic or congested and of rather a maroon color. Mention has been made of the hyperplastic regional mesenteric glands. The mesentery may not be thickened and edematous. Karl Meyer believes that the state of the mesentery may be an indication as to treatment; that is, whether to resect, shortcircuit, or leave alone.

The inflammatory process may be limited to one segment of the bowel or, as in one of our series, may involve several loops. Fistulas and walled off abscesses may be found between the loops of bowel. The intestinal coats are greatly thickened and edematous. Ulcerated areas may appear along the mesenteric border of the mucosa and show a tendency toward perforation. Microscopic study shows acute, subacute, or chronic inflammatory changes. Giant and epithelioid cells are present in the later stages.

TREATMENT

Proper surgical treatment is still a question for discussion and will not be determined until the results in cases in which operation has been done have been further studied. Treatment must be governed by the progress of the disease and the condition of the patient. Many acute cases must occur in which spontaneous recovery results. What is the proper procedure when the acute phase is encountered? Mixter prefers a one stage resection in uncomplicated cases but feels that multiple stage operations are indicated when abscesses or fistulas exist. He believes that the hazards of operative intervention should be emphasized and points out that technically the operation is difficult due to severe hemorrhage caused by mobilization of the bowel, the extreme thickening of the mesentery, and at times the presence of complicating fistulas. Mixter does not favor graded procedures in the early cases and reports that he had no case in which a cure was accomplished short of resection of the diseased intestine.

Meyer believes that if the inflammation is limited to the terminal ileum and the mesentery is uninvolved, resection may not be necessary, since the process may resolve spontaneously. Even when ulceration of the ileum has extended into the mesentery, he feels that a shortcircuiting operation may suffice. This was my experience in Case 3 of our series.

I question the advisability of subjecting these rather poor surgical risks to the hazards

Fig. 4. Filling defect in the terminal ileum, opaque meal administered by mouth.

Fig. 5. Specimen injected after resection shows a characteristic filling defect.

of resections of considerable portions of the small and large intestine. It might be well to permit sufficient time to elapse to observe what course the disease might follow. This is contrary to Mixter's experience, who states that he has observed in a very considerable number of cases without demonstrable fistulas or abscesses that the disease has progressed from a simple primary lesion following a first stage procedure, so that the secondary operation became definitely more hazardous. Mixter reports a mortality of 36 per cent. Dixon, however, feels that if the patient is in poor condition, an ileocolostomy is the procedure to be employed, subsequent resection depending on whether the patient is rendered symptom-free by the shortcircuiting operation. He believes that in more than 50 per cent of the cases resection will be necessary.

What is the fate of the sidetracked loop of bowel? In Case 3 in our series, roentgenological examination disclosed no abnormal changes. This is still open to discussion, as Holm found that the loop was likely to become greatly elongated, dilated, and ulcerated.

CASE REPORTS

The subject of regional enteritis merits our closest attention and our carefully considered opinion. In order that future knowledge and experience in the care of this strange malady may be available to all, this preliminary study should be followed by a later survey. A summary of the cases seen at the Jackson Clinic together with a résumé of those of members of the Western Surgical Society follows:

CASE 1. Female, aged 56, years was first seen by my brother in 1909, at which time her age was 29; she had recently had four attacks of right lower quadrant pain, vomiting, and diarrhea. A diagnosis of appendicitis was made and an interval operation was done. At operation, free, clear, ascitic fluid, grade 1, was noted. The wall of the terminal 24 inches of the ileum was found to be definitely thickened, edematous, anemic, and dusky in appearance. The appendix, which showed no evidence of acute inflammation, was removed. At the time, the water logged, doughy condition of the terminal ileum with its dusky hue which also pervaded the fan shaped vascular supply area, was interpreted as due to a limited mesenteric thrombosis in which recovery of circulation was progressing favorably. Judging by subsequent history, this was the initial stage of a terminal ileitis.

From time of operation until 1922, patient had had attacks of abdominal cramps and vomiting which occurred every few months and lasted 2 to 3

Fig. 6. Arrow points to string sign.

Fig. 7. String sign in terminal ileum.

weeks. She was free from 1922 to 1929, when the attacks of severe abdominal cramps recurred; visible peristalsis was present. The attacks were severe enough to require morphine for relief.

Diagnosis: chronic intestinal obstruction.

Operation was done in May, 1929. A very thick walled, leather-like condition of the cecum and lower 28 inches of ileum was found. There were several large glands in the mesentery. The lower ileum and cecum were resected. Figure 2 (above) shows the unopened specimen. In Figure 1 note the tremendous hypertrophy of the walls. The specimen was sent to Professor C. H. Bunting as a possible form of abdominal Hodgkin's disease. His note follows: "What you took for submucosa and what I took for submucosa until I got sections, is a marked, almost neoplastic hypertrophy of the circular muscle coat. The muscle cells are as large as those in the pregnant uterus. The only other pathology is an unexplained infiltration with eosinophilic cells from mucosa to subserous layer. Lymphoid apparatus appears normal."

Patient was free from attacks after operation until October, 1934, when the same cramp-like pains recurred every few days.

Gastro-intestinal series of roentgenograms showed the following: the loop of distal ileum approximately 30 centimeters long, proximal to anastomosis with ascending colon is reduced in diameter to 1 centimeter or less, is inelastic, and shows moderate dilatation proximal to the contraction. Reflux barium through the site of the anastomosis confirms the described filling defect in the distal ileum. Diagnosis: inflammatory infiltration in wall of a loop of distal ileum.

A third operation was done January 1, 1935. The wall of the last 3 feet of the ileum was found to be greatly thickened, indurated, and narrowed. There was an exact reproduction of the condition noted at the preceding operation. Five and one-half feet of terminal ileum, the ascending and one-half the transverse colon were resected; side-to-side anastomosis was done. In Figure 1 it is evident that the anastomotic opening into transverse colon is ample and that the peculiar lesion in the small bowel has not invaded the wall of the colon, the mucous membrane of which is normal. Professor Bunting's note on this specimen: "The lesion is like that of 5 years ago and is to me unique. There is a subacute or chronic inflammation involving mucosa, submucosa, muscular layer and subperitoneal tissues. There are many lymphoid and mononuclear cells and also fibroblasts; but strikingly many eosinophiles."

Patient free of symptoms since the last operation.

Diagnosis: regional ileitis.

My interest in this subject was first aroused by the following case. Patient was operated upon by my brother and myself in 1927.

CASE 2. Male, aged 57. The patient had complained for several months of intermittent attacks of abdominal cramps associated with nausea and vomiting and there had been alternating spells of diarrhea and constipation. Temperature ranged from 100 to 101.0 degrees during these attacks.

Fig. 8. Arrow points to concave filling defect in ileal cecal valve caused by protrusion of infiltrated ileal wall into cecum.

There had been marked loss of weight and strength with secondary anemia. Roentgenological examination had not revealed the cause of the complaint.

Exploratory laparotomy revealed a most unusual and, in our experience, unheard of condition. The first 3 feet of the jejunum presented what we now know to be the characteristic appearance of regional enteritis. On account of the location and extent of the lesion, resection was not feasible. The terminal duodenum and the proximal jejunum with their greatly thickened walls were approximately the size of the colon, but gradually tapered off into normal walled jejunum. There was no proof of definite obstruction. The adjacent mesentery contained many enlarged glands. The patient survived a year.

Case 3. Male, aged 26, entered the hospital December 3, 1935. In March, 1935, patient suffered with abdominal cramps, bloating, and diarrhea. Blood appeared in the stools 2 weeks later. Following appendectomy at another hospital in May, 1035, pain and diarrhea were relieved but persisted. In late November, 1935, the abdominal cramps again became severe. During height of cramps, a mass was felt in abdomen which disappeared with cessation of pain. Total loss of weight 40 pounds.

Proctoscopic examination showed spastic bowel, edematous mucosa, but no evidence of ulceration.

Fig. 9. String sign in terminal ileum.

Blood examination showed hemoglobin, 75 per cent; red blood count, 5,800,000; white blood count 13,500. The Kahn test gave negative reaction.

Roentgenograms of the gastro-intestinal tract showed that in the prececal ileum there was cannulization of the lumen, and next to this marked dilatation. At 24 hour intervals, this cannulization was again demonstrated in the ileum, with retention proximal to the defect.

Diagnosis: regional ileitis.

Operation was done December 11, 1935. The lower ileum was explored and revealed a marked narrowing, thickening, and hypertrophy of the wall in the last 10 inches, with many enlarged glands in the mesentery. The healthy ileum wall above the lesion was anastomosed to the ascending colon. The patient made a good recovery.

Following the operation there were occasional attacks of dull pain lasting 2 to 5 hours, which gradually subsided. Patient is now, a year after operation, free from all symptoms, has gained 50 pounds, and eats whatever he desires.

Case 4. Female, aged 16 years. This girl was admitted to the clinic March 17, 1936. Onset of present illness was in August, 1935, when she had abdominal cramps and vomited. A month later a similar attack occurred. In October the attacks became more frequent and in November the pain became localized in the right lower quadrant; she was operated upon elsewhere. The surgeon reported that on opening the abdomen he encountered an agglutinated mass of small bowel around the appendiceal region and in digging out the appendix, he opened a

Fig. 10. Roentgenogram showing string sign in the terminal ileum.

Fig. 11. String sign in terminal ileum.

Fig. 12. Roentgenogram showing 24 hour retention in the terminal ileum.

small abscess of creamy, odorless pus in the mesoappendix. The appendix itself was not greatly inflamed nor was it perforated. After the appendectomy, a cigarette drain was placed to the site of the pus pocket; the resulting sinus remained patent for many weeks. Following operation, the attacks of abdominal pain and vomiting continued with the development of anemia, loss of weight, and general lassitude. Temperature ranged from 100 to 101 degrees.

Fig. 13. Regional enteritis showing enlarged mesenteric glands and hose-like thickening of the last 8 inches of the ileum.

TABLE I.—CASES OF REGIONAL ENTERITIS REPORTED BY MEMBERS OF WESTERN SURGICAL SOCIETY

	Cases
Number of cases	64
Number operated upon	64
Result	
Cured	50
Improved	3
No change	1
Died	10
Type of operation	
Shortcircuit ileocolostomy	14
Resection	49
Appendectomy	9
Members reporting not having had a case	45

TABLE II.—CASES OF REGIONAL ENTERITIS REPORTED BY JACKSON CLINIC

	Cases
Number of cases	5
Number operated upon	4
Result	
Cured	3
Improved	0
Died (1 year following operation)	1
Type of operation	
Shortcircuit ileocolostomy	1
Resection	2
Exploration	1

X-ray diagnosis: obstruction at the ileocecal valve.

Clinical diagnosis: terminal ileitis.

Operation was done March 18, 1936. A typical hose-like thickening of the last 18 inches of the ileum was found with several enlarged mesenteric glands.

Surgical diagnosis: regional ileitis.

The affected ileum and half of the ascending colon were resected and lateral anastomosis was done.

Figure 13 shows specimen during operation, and Figure 2 (below), specimen after removal. The fresh specimen was sent at once to Professor C. H. Bunting who at first thought the etiological factor was due to a fungus organism but repeated efforts to cultivate this organism failed. Figure 5 is a roentgenogram of the barium filled specimen. There is a material reduction in the lumen of about 20 centimeters in the distal ileum with cannulization in the prececal region.

Diagnosis: inflammatory infiltration of the wall of the distal ileum (regional ileitis).

Patient has remained well since operation.

CASE 5. Female, aged 35 years, was first seen at the clinic March 31, 1936. For 2 months, she had had daily attacks of cramp-like pain in the lower abdomen lasting 2 to 3 hours. The pain occurred usually after the noon meal and was partially relieved by lying on the abdomen. No borborygmus and no nausea or vomiting were associated with the pain; the bowels were constipated and the daily use of a laxative was required.

Blood examination showed: hemoglobin, 75 per cent; red blood cells, 5,400,000; white, 7,900.

TABLE III.—REPORTED CASES OF REGIONAL ENTERITIS IN THE UNITED STATES

		Cases
1932	Crohn, B. B.; Ginzburg, L.; Oppenheimer, G. D.	14
1933	Clute, H.	2
1933	Harris, F. L.; Bell, G. H.; Brunn, H.*	3
1933	Homans, J.; Haas, G. M.	2
1933	Ladd (Reported in discussion)	2
1933	Rockey, E. W.	4
1934	Brown, P.; Bargen, J. A.; Weber, H.	18
1934	Colp, R.	1
1934	Core, P.; Boeck, W.	1
1934	Donchess, J. C.; Warren, S.	1
1934	Stout, F.; Hoagensen; Smith	1
1934	De Courcy, J. L.	1
1934	Bissell, A. D.	2
1934	Phillips, K. T.	1
1935	Erb, L. H.; Farmer, A. W.	4
1935	Erdmann, J. F.; Burt, C. V.	5
1935	Galamos, A.; Mittelmann, W.	2
1935	Mixter, C. G.	11
1936	Lee Discussion Mixter paper	1
1936	Goetsch, E. Discussion Mixter paper.	1
1936	Brunn, H.* Discussion Mixter paper.	2
1936	Binney Discussion Mixter paper	2
1936	Strauss, A.; Rosenblate, A.; Goldsmith, A.	1
1936	Meyer, K.*	8
	Reported in this Survey	2
1936	Connell, F. G.*	2
1936	Crohn, B.; Rosenah, B.	9
1936	Probstein, J. G.; Gruenfeld, G.	3
1936	Kantor, J. L.	6
1936	Taylor, J. L.	2
1936	Jackson, A.*, R. H.*	4
1936	Western Surgical Society Members	64
	Total	182

NOTE: Crohn recently reports a diagnosis of 60 cases or 37 more than already reported, making a total of 219 cases reported in the United States to date.

*Member Western Surgical Society.

The gastro-intestinal series of roentgenograms showed conspicuous evidence of cannulization of a loop of distal ileum immediately prececal ("string sign"). Colon, by clysma: Reflux into the ileum confirms the presence of a filling defect in the distal ileum as previously described.

Diagnosis: inflammatory infiltration into wall of distal ileum. Clinical diagnosis: regional ileitis.

Operation was advised but refused; patient has not been seen since.

SUMMARY

1. To the 114 cases of regional enteritis which have appeared in the American literature since Crohn's classical description in 1932, there are added 4 cases from the Jackson Clinic and 64 from a survey of the Western Surgical Society, making a total of 219 cases.

2. Regional enteritis may simulate appendicitis and appendectomy has frequently been performed without relief of symptoms.

3. This disease, like mesenteric lymphadenitis, is probably due to a low grade infection of lymphatic system. Its etiology is unknown.

4. The symptoms depend upon the stage, the location, and the severity of the disease.

5. The important symptoms are pain, often severe and cramp-like, diarrhea, vomiting, fever, and loss of weight. A mass may be palpated.

6. The disease may occur in either the small or large intestine, but is most often observed in the terminal ileum.

7. Determination of the diagnosis depends upon the roentgenologist. A filling defect in the terminal ileum, distention proximal to the defect, and the characteristic "string sign" are typical.

8. Pathological findings vary according to the stage of the disease. The thickened mesentery, enlarged glands, and the hyperemic enlarged hose-like intestine are typical.

9. Proper surgical treatment is still a question for discussion. In 2 cases in this series resection was performed and in another ileocolostomy with equally satisfactory results.

10. The type of operation to be performed depends upon the individual case. Resection is not advised in debilitated patients. In some cases entero-anastomosis will not suffice and resection will be required to relieve symptoms.

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THE ADVANTAGES OF GRADUAL DECOMPRESSION FOLLOWING COMPLETE COMMON DUCT OBSTRUCTION

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THE effects of the rapid release of increased intravisceral pressure in most of the systems of the body have been studied and described. Creevy stated that the Ebers *Papyrus* gives a method for preventing the too rapid withdrawal of urine from the distended urinary bladder. Although Creevy thought that the effects of sudden relief of the greatly distended bladder were overestimated, VanZwalenburg, Hirsch, Campbell, Bumpus and Foulds, and many others, believed that renal and circulatory collapse did at times follow sudden bladder and urinary tract decompression. Bumpus and Foulds stated that "if the chronically distended bladder is emptied rapidly and completely at one time, the sudden reduction of the intravesical pressure results in immediate congestion throughout the urinary tract with resulting edema and hemorrhage which may be so severe as completely to suppress renal function."

Plumier, Thorington and Schmidt, and others have studied the effect of increases in the abdominal pressure on the arterial and venous pressures. Brams, Katz and Kohn have reported on the effect of abdominal distention and release on the blood pressure in the carotid artery and the veins above and below the diaphragm. They observed that after the release of marked abdominal distention which had persisted for some time, the fall in arterial pressure was as much as 40 millimeters of mercury. They wisely cautioned that such a drop "in a feeble patient might result in death."

McLaughlin and Levering found that "the rapid release of the (greatly increased) intragastric pressure, even when this had been maintained for only a short period, resulted in profound changes in the arterial system."

From the Harrison Department of Surgical Research and the Department of Surgery, School of Medicine, University of Pennsylvania. Aided by a grant from the Josiah Macy, Jr. Foundation.

Elman has reported on the acute crises that are observed in certain cases after the sudden release of a greatly distended intestine, especially the small bowel. This reaction simulated shock in many respects and a number of the cases cited progressed steadily to a fatal outcome. A precipitous fall in blood pressure has been noted in such cases. Aird has produced the same train of events in experiments designed to study the effect of rapid deflation of the distended bowel.

For some years we have been interested in the pathologic physiology of common bile duct obstruction. Certain of the changes which are observed once the common bile duct becomes obstructed are not unlike those observed after obstruction in other viscera. We wish to discuss certain of the changes incident to common bile duct obstruction together with what we believe to be a rational plan of management following removal of the obstruction.

Changes in the liver cells following common duct obstruction. When the common bile duct becomes obstructed the liver cells continue to secrete bile until the intraductal pressure reaches the secretory pressure of the liver. The time at which this suppression of secretory activity of the liver cells occurs depends in large part upon the state of the gall bladder at the time of the obstruction and the condition of the liver.

If the gall bladder is capable of absorption, bile may continue to be secreted for hours, while if the gall bladder is so damaged that absorption through its wall is no longer possible, or worse still, if it is so severely damaged that fluid pours into its lumen from the wall, the intraductal pressure may rise so abruptly that secretory suppression of the liver results within a very few hours.

The liver is at best an organ which cannot be rapidly distended to any great extent. The capsular covering of this organ does not so

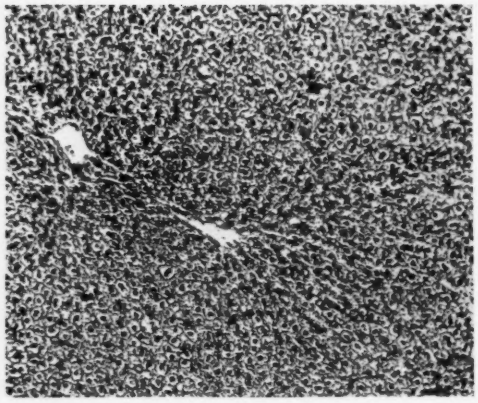

Fig. 1. Photomicrograph showing appearance of the normal liver. ×90.

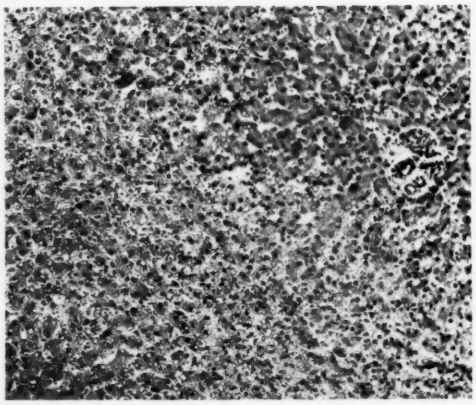

Fig. 2. Photomicrograph showing areas of "icterus necrosis" and dilated biliary radicals and areas of marked degeneration of hepatic cells. × 90.

readily accommodate itself to increases in intravisceral tension as do the hollow viscera. Furthermore, when as a result of infection there exists considerable cirrhosis, distention becomes more difficult and the problem even more critical.

The intrahepatic ducts dilate at the expense of the hepatic cells and blood vessels. The portal venous circulation suffers most. Normally the portal pressure is low and as the intraductal pressure increases the flow of portal venous blood through the liver is greatly retarded. There occurs portal venous stagnation which is reflected backward to the abdominal viscera whose venous return is through this system.

Many years ago, Frerichs reported on the lesions of the liver cells which may be seen following portal venous obstruction. Eppinger has called attention to the areas of "icterus necrosis" and others have observed areas of such size as to call them "biliary infarcts." While some writers have believed that human bile is incapable of producing permanent hepatic cell injury, Rous and Larimore have stated that, "If this be true man differs from all other well studied animals." Figures 2 and 3 show a few of the changes in the cytology of the liver which occur shortly after obstruction of the common bile duct.

The portal circulation is not alone affected by the ductal occlusion but as the pent-up biliary and ductal secretion accumulates the arterial circulation suffers in a lesser degree. Nevertheless, the combined effect is to provide a degree of hepatic anoxemia which, as Rich has shown, causes histologic changes in the hepatic cells.

The effect of portal venous stasis on the circulation. Since the portal venous system drains a large part of the blood from the abdominal viscera, obstruction to it has additional effects. The stagnation of blood in the intestinal tract and other viscera leads to an increase in the blood volume in this part of the circulatory system and a decrease in the circulating blood volume. The degree to which this may occur is in part dependent on the efficiency of the collateral venous anastomosis.

The bilious ascites that is so frequently observed in varying degrees following common duct obstruction is in part an expression of the rise in pressure in the capillaries. The circulation time through the capillaries is increased and there may result an excessive reduction of the oxygen content of the blood in this region of the vascular system. The accompanying anoxemia leads to an increased permeability of the capillary wall and causes an increased passage of fluid through it.

Decompression. While the obstruction of the common bile duct may in itself produce serious cytological changes in the liver and

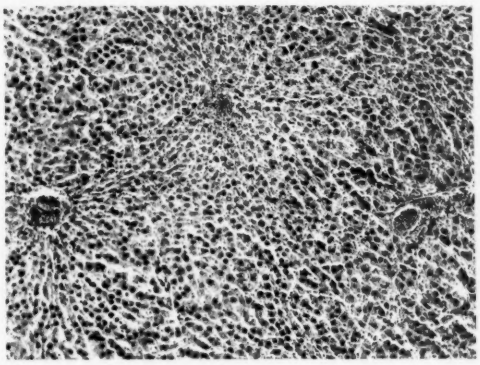

Fig. 3. Photomicrograph showing the dilated biliary capillaries and marked passive congestion resulting from common duct obstruction. × 80.

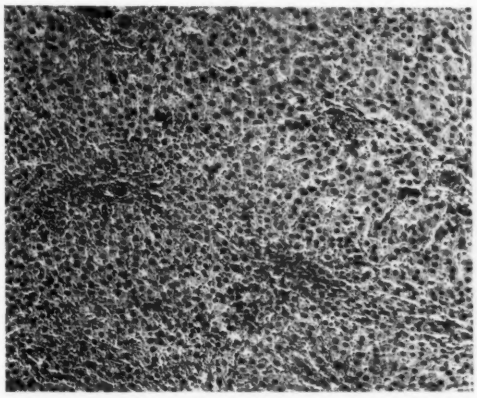

Fig. 4. Intense hyperemia and the extravasation of blood into the biliary capillaries following the sudden release of complete common duct obstruction. × 90.

physiological changes in the portal venous circulation, it is equally true that the rapid release of the obstruction with the sudden inflow of blood into hepatic vessels whose circulation was in varying degrees impeded may lead to equally serious consequences. The intense hyperemia which takes place when a complete ductal obstruction is suddenly released (Fig. 4) may cause additional damage to the liver cells and changes in circulation.

The difference of opinion now expressed in the literature as to whether compression or decompression produces changes in the urinary tract may possibly be explained by the assumption that both processes produce cytologic and physiologic changes. Which one may cause the most marked alteration in function may in part be associated with the rapidity with which compression or decompression is accomplished.

Mont Reid, in discussing certain possible advantages of biliary decompression, stated:

> The effect of cysticocholedochostomy or some modification of it may afford a means of gradually releasing the bile pressure in the biliary apparatus.
>
> I have frequently observed that the drainage of common bile duct of deeply jaundiced patients is followed by a serious toxic state characterized by listlessness, normal or subnormal temperature, and a tendency to sleep. I have not seen this toxic state in non-jaundiced patients, and it would seem, therefore, to be due not merely to the loss of bile, but rather to the effect of the release of the bile pressure. The same effects have been noted when deeply jaundiced patients were relieved of their bile pressure by anastomosing the gall bladder to the stomach or intestine.

In 1926, one of us (14) reported that he had used a method which provided for a type of gradual decompression and that he thought the matter should be further investigated. The problem, however, has received scant attention. For some years we have used the following method of decompression after the release of an obstructed common bile duct.

Method. As soon as the T-tube has been sutured in the common duct and bile begins to flow from it, it is clamped. When the

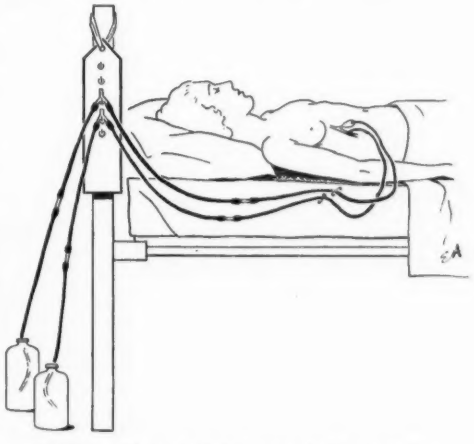

Fig. 5. Diagram of decompression apparatus.

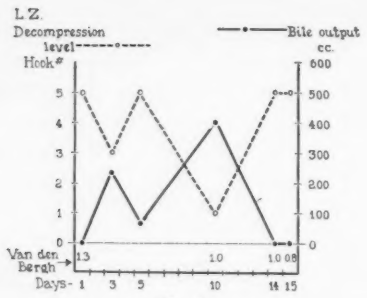

Fig. 6.

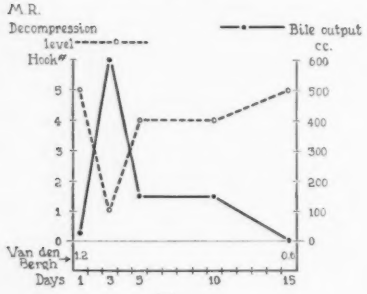

Fig. 7.

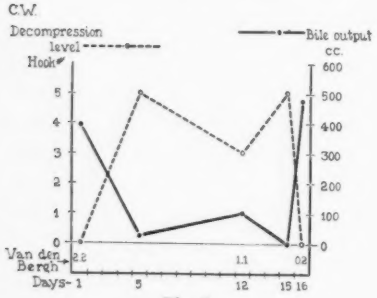

Fig. 8.

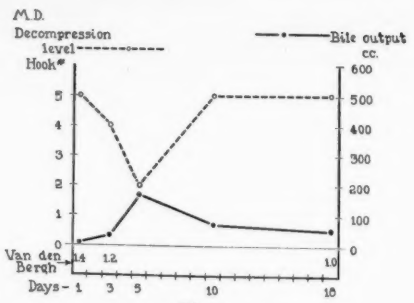

Fig. 9.

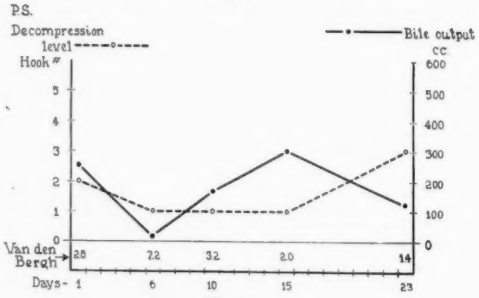

Fig. 10.

Figs. 6 to 10. Bile output in patients after choledochostomy and the attachment of the decompression apparatus.

patient returns to the ward, the clamp is removed and the tube is connected to the sterile decompression apparatus (Fig. 5). If a cholecystostomy has also been performed, the gall-bladder tube is attached to a similar apparatus. The apparatus board is so fastened as to put the lowest hook approximately on a level with the common duct. The distance between the hooks is approximately 5 centimeters. For the first 12 to 18 hours after operation the Y-tube is hung on the top hook approximately 25 centimeters above the level of the common duct. The usual result is that only a little bile is forced over into the drainage bottle with respiratory movements. The Y-tube is then moved downward but if, at this level, a large amount of bile is drained externally, this can be lessened by raising the tube again. By thus adjusting the level of the apparatus, the amount of bile drained externally can be regulated. Enough is obtained daily for analytical studies and the remainder is forced down into the duodenum by controlling the level of the Y-tube. In order to do this the level must be changed from time to time to compensate for changes in the condition of the common duct and the tonus of the sphincter of Oddi.

Thus, as the postoperative traumatic edema of the ductal wall subsides, the level can be lowered, but in order to overcome the sphincter tone, a certain amount of pressure must always be maintained by keeping the Y-tube on the second or third hook. That the bile is passing into the duodenum can

readily be determined by frequent observations of the patient's stools and repeated van den Bergh determinations. In Figures 6, 7, 8, 9, and 10 are shown the variations in the bile drainage in a group of the patients on whom this apparatus has been used, when the level of the tube is moved up or down to maintain the conditions described above. The various levels are indicated by the numbers 1 to 5, 1 representing level of common duct and 5 a point about 25 centimeters above this.

Other advantages. While the advantages of gradual decompression of a chronically distended biliary ductal system must be clear from the cytologic and physiologic point of view, there are additional advantages of no mean importance. The forcing of bile into the duodenum, once the obstruction is relieved, which prevents the loss of bile to the exterior, is of great value.

It is only necessary that the pressure from the decompression apparatus be sufficient to overcome the tonus of the sphincter mechanism at the lower end of the common bile duct for the bile to flow freely into the duodenum.

Formerly the method of simply allowing the bile to drain into a bottle hung at the side of the bed exerted, if anything, a suction effect. In many cases this resulted in the drainage of large amounts of bile.

The loss of fluid and electrolytes when the bile is thus drained to the exterior is considerable, but of even more importance is the loss of the intestinal functions of the bile.

While the externally drained bile may be returned to the patient through a Jutte tube into the stomach, it is often impossible to administer all the bile drained externally by this method and the procedure is distasteful to the patient. In the method which we advocate the bile enters the duodenum by its normal route. Appetite improves rapidly and "pancreatic asthenia" has not been observed during convalescence.

SUMMARY

We have discussed the possible effects of obstruction of the common bile duct on the cytology of the liver cells and upon the portal blood flow. The effects of a rapid release of complete common bile duct occlusion has also been discussed and a method presented for slowly decompressing the system after release of the obstruction. The method suggested obviates the necessity of feeding the patient bile during the postoperative period and results, we believe, in a smoother convalescence.

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THE DISRUPTION OF ABDOMINAL WOUNDS

A Report of 22 Cases

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A COMPLICATION of abdominal surgery with which every surgeon is familiar is the disruption of wounds. That it is a serious accident is revealed by the mortality rate of 22 to 50 per cent, reported in a series of publications on the subject. This fact should stimulate surgeons to seek measures whereby such complications may be avoided.

The wisest attack upon the problem would seem to be a study of the incidence, etiology, and treatment of evisceration. That effort has been expended in this direction is indicated by a growing literature, many papers having been written by surgeons with wide experience. However, it is difficult from these papers to obtain accurate information regarding the frequency of evisceration, for few authors state what percentage of their abdominal wounds broke down. Accurate data, also, are lacking concerning the use of different suture materials in large series of cases, and there are conflicting opinions regarding etiology and treatment of disruption of wounds.

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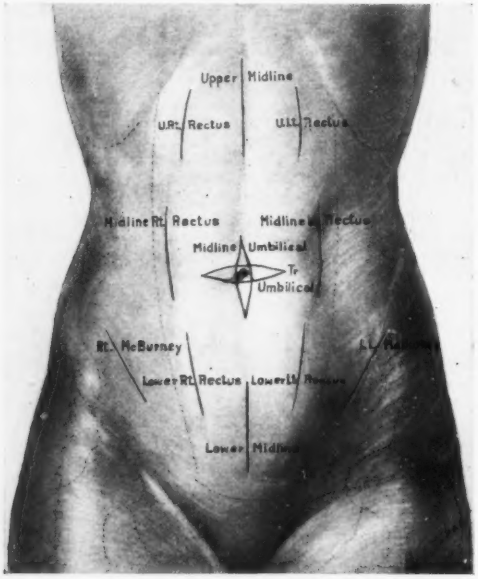

Fig. 1. Location and designation of incisions employed.

Several variable factors must be considered in regard to every abdominal wound, such as the location of the incision, the suture material used in closing, the operation performed, the lesion, whether malignant or non-malignant, and whether infection was present previous to operation or introduced during the operative procedure.

For the purpose of making a comprehensive study of the problem of evisceration on the surgical service of the New York Hospital, the records of all patients upon whom abdominal operations were performed between September 1, 1932, and April 30, 1936, were reviewed with respect to the factors named. It is believed that by this means all cases of disruption were brought to light and the fullest possible data obtained on them. A total of 2,927 records was reviewed and the data classified; 22 cases of evisceration were disclosed—an incidence of 0.75 per cent. The results of the study are shown in a series of tables.

The literature on disruption of wounds will be referred to only in making comparisons. Excellent reviews of the subject have been made by Jenkins and others.

ANALYSIS OF 2,927 ABDOMINAL OPERATIONS

In order to establish correct figures for the incidence of evisceration and for certain factors which may affect it, it obviously is necessary to know facts, not only concerning the cases of disruption, but concerning the series from which these cases were drawn. To obtain this information, a careful analysis of the 2,927 abdominal operations was undertaken.

TABLE I.—GENERAL INFORMATION

Number of abdominal operations	2,927
Total eviscerations	22
Incidence, per cent	0.75
Deaths	10
Mortality, per cent	45.45*

*The 10 deaths due to evisceration accounted for 0.34 per cent of the total mortality for all abdominal operations.

It was found that record room files, operating room cards, and operative notes on each case had to be consulted to complete the study. Table I shows the general information obtained.

A table was compiled to show the influence upon the incidence of evisceration of the site of the incision (Fig. 1), and it includes figures regarding the suture material used in closing each type of wound (Table II).

Tables III A and B approach the subject from a different viewpoint. Here the figures are given for incidence of evisceration in various operations and again reference is made to the suture material employed.

It will be noted that catgut was used in closing 1,608 wounds, silk sutures in 1,144, and silver wire in 175 cases. For the sake of clarity, a brief description of the suture materials and methods and the terminology applied to them will here be given.

I. CATGUT CLOSURE

a. Interrupted catgut closure. The peritoneum is closed with a continuous suture of Zero plain or No. 1 20 day chromic catgut. The fascia is approximated by a series of interrupted sutures of chromic catgut No. 1. Stay sutures of silkworm or "Dermo" are placed so that they embrace the fascia only.

b. Interrupted catgut closure with figure of 8 sutures. This is a modification of *a*; instead of interrupted chromic sutures, the figure of 8 type of suture with No. 1 20 day chromic is employed.

c. Interrupted catgut closure with drainage. No. 1 20 day chromic catgut is used to close the peritoneum. Instead of one continuous suture, one continuous suture starts from each extremity of the wound and is brought to the point where the drain emerges. At this point on either side of the drain, a single reinforcing suture of the same material is placed. The single suture is referred to as a "safety suture." The fascia is closed in the manner described and stay sutures complete the closure.

II. SILK CLOSURE

a. Silk closure without drainage. A continuous suture of twisted surgical silk No. 7 approximates the peritoneum and interrupted sutures of the same material unite the fascia. When stay sutures are employed they are of the same silk and form a lateral figure of 8, including the fascia. The subcutaneous tissues and skin are closed with interrupted silk (No. 5) sutures.

TABLE II.—SITE OF INCISION, SUTURE MATERIAL

Incision	Catgut	Silk	Silver wire	Total	Eviscerations	Per cent
Upper right rectus	630	287	120	1,037	13	1.21
Upper left rectus	42	46	17	105	2	1.90
Lower right rectus	279	69	14	362	2	0.55
Lower left rectus	84	24	11	119	2	1.68
McBurney, right	488	609	1	1,098	1	0.09
McBurney, left	6	0	0	6	0	
Upper midline	1	16	1	18	0	
Lower midline	42	29	5	76	0	
Mid midline	4	35	0	39	0	
Mid right rectus	16	14	5	35	0	
Mid left rectus	5	1	1	7	1	14.00
Paracostal	9	2	0	11	0	
Transverse rectus	1	0	0	1	1	100.00
Transverse umbilical	1	12	0	13	0	
Totals	1,608	1,144	175	2,927	22	0.75

TABLE III A.—OPERATION, SUTURE MATERIAL

Operation	Catgut	Silk	Silver wire	Total	Eviscerations	Per cent
Appendectomy	671	626	6	1,303	1	0.07
Biliary tract operations*	414	131	52	597	8	1.34
Stomach operations	168	75	63	306	4	1.30
Small bowel operations	50	14	14	78	1	1.28
Large bowel operations	123	81	21	225	5	2.22
Pelvic operations	113	29	2	144	0	0.
Exploratory laparotomy	20	20	4	44	1	2.27
Ventral hernia repair	24	128	1	153	2	1.31
Splenectomy	7	23	2	32	0	0.
Miscellaneous	18	17	10	45	0	0.
Total	1,608	1,144	175	2,927	22	0.75

TABLE III B.—SUTURE MATERIAL, SUMMARY

Suture material	Total	Eviscerations	Per cent
Catgut	1,608	11	0.68
Silk	1,144	7	0.61
Silver wire	175	3	1.71*

*One disrupted wound was closed with through-and-through silkworm gut.

b. Silk closure with drainage. This closure is the same as *b* above except that silk, No. 7, is used in place of catgut. The safety sutures of silk are employed. Stay sutures may or may not be used; the subcutaneous tissues are not approximated, unless they are unusually thick. Ordinarily the deep skin sutures (No. 5 silk) suffice to bring these tissues into approximation and reaction around the drain is less likely to persist in the surrounding tissues if sutures are omitted.

III. SILVER WIRE CLOSURE

Through-and-through silver wire closure. A suture of silver wire is introduced from the skin through the subcutaneous tissues and fascia down to and through the peritoneum and is then returned to the skin, layer by layer. Silver wire sutures should be placed not more than 3 centimeters apart. When they have all been placed, they are drawn tight and each one is secured separately by twisting. No guards to protect the skin from the wires are employed. The wire is No. 20 round silver wire.

It may be said that considerable latitude is granted the members of the surgical service of the New York Hospital in the selection of suture material and slight modifications in procedure also are noted. It is the opinion of the authors that, to prevent evisceration, the safest closure is the through-and-through silver wire method developed and popularized by French surgeons and more recently described by Reid *et al.* In this series 175 abdominal wounds were closed in this manner. Without exception these were cases in which it was felt that disruption was most likely to occur, i.e. in individuals with massive abdominal infections, with extremely obese abdominal walls, with poor musculature, or else in debilitated patients suffering from malignant disease. In the analysis of cases, three disruptions are credited to silver wire closure, but in none of these was the method at fault. In one the wire broke because it was of smaller caliber than usually employed; hence, the evisceration was due to material rather than procedure. The wires in another patient were not twisted enough to resist the pressure exerted by a muscular abdomen under tension. In a third case all wires were removed at one time which is contrary to the prescribed procedure.

In the group of disrupted wounds, the secondary closure was accomplished with silver wire in all but 4 cases. It is worthy of note that not one of the secondary closures broke down; a further evidence of the efficiency of this method of closing. It is recommended, therefore, that silver wire closure be used in the presence of massive abdominal infection, in wounds which have been grossly contaminated by gastro-intestinal contents, and in all patients debilitated by malignancy or long standing chronic disease associated with anemia. In other types of cases silver wire closure is not indicated nor is this method of closure required.

There are definite rules and requirements which must be met in the use of silver wire: (1) The several layers of the abdomen must be carefully approximated to avoid massive scar formation, which may be a potential factor in postoperative weakness of the abdominal wall. (2) The wires must be placed with meticulous care to prevent the inclusion of a segment of intestine or omentum in the concealed loop of silver wire as it is drawn tight. Reid *et al* report 334 cases closed with through-and-through silver wire without a disruption, but they cite several instances in which a loop of bowel or omentum protruded between two wire sutures. Such instances in our series have been included in the eviscerations. (3) Gauge 20 round silver wire should be used. It has been found that this size wire, as furnished by a number of manufacturers, possesses sufficient tensile strength to maintain any abdominal wound in proper approximation, provided the sutures are placed not more than 3 centimeters apart. Wire of smaller caliber, though it may be equally strong, has a greater tendency to cut through the edges of the wound. (4) Guards between the silver wires and the skin are not employed, for it has been found that a greater degree of necrosis results when such protective agents are used. (5) The sutures should be removed one a day after the fourteenth or fifteenth days. (6) Before removal, the silver wire and skin should be disinfected, for it is obvious that otherwise infection might be carried by them into the peritoneal cavity. (7) Continuous buried metallic sutures are not advocated in abdominal closures, for reaction to a foreign body over a long period of time may lead to abscess formation.

One definite disadvantage in the use of silver wire in closure, is in connection with drainage, for, on account of its bulk, it diminishes the space through which the wound is drained.

In a closer study of these abdominal operations in regard to evisceration, little difference will be noted in the results of silk and catgut closures. However, it is the opinion of the authors that if silk were used with proper discrimination, the results with it would be better than those with catgut. The suitable cases for silk sutures are without gross infection. In the presence of infection, a catgut closure is preferable. It is employed in the majority of abdominal closures here as elsewhere in this country. Though the authors have no positive convictions concerning the comparative value of silk and catgut, they are convinced that both should never be used in the same wound. When used alone in a clean wound there is no reaction around silk sutures. Some reaction takes place as catgut sutures are absorbed. The exudation of white cells and serum around the catgut sutures may invade the region of the silk sutures, which then become foreign bodies. A "sterile abscess" may result and there is induration and tenderness until the silk suture is cast out of the wound. The injudicious use of these two suture materials in the same wound has cast discredit upon silk sutures.

Table IV shows the effect on the incidence of evisceration of malignancy. It also indicates the seriousness of this accident in malignant cases, for the mortality will be seen to be more than twice as high after operations for malignant conditions than for non-malignant conditions.

Certain facts are revealed by a study of the four tables thus far presented. In Table II it will be seen that mid left rectus and transverse rectus incisions are rightfully used with great reserve, for the incidence of evisceration in both is very high. Of the usual incisions in the upper abdomen, the upper left rectus carries the highest percentage of disruptions in this series. Only one McBurney wound disrupted; in this case the closure was inadequate and the drains were of such bulk as to prevent the wound from closing. The high incidence of evisceration noted under "Large bowel" in Table III may be accounted for by the fact that many cases of carcinoma were included under this heading (198 out of 225). That malignancy very seriously affects the incidence and results of evisceration is shown in Table IV.

TABLE IV.—EVISCERATION IN MALIGNANCY

	Malignant disease	Non-malignant disease
Total cases	582	2,345
Eviscerations	6	16
Incidence, per cent	1.20	0.67
Mortality from eviscerations, per cent	83.33	31.25

The data which have been tabulated and discussed so far have to do with evisceration in its relationship to the total number of abdominal operations. Table V concerns the cases of disruption. Each item in the table will be discussed briefly.

Unlike many reports on the subject of eviscerations, this report is marked by a preponderance of male patients (91 per cent). Meleney and Howes report 70 per cent, Colp 54 per cent, and Maes 49 per cent males in their series. Although the exact figure is not available, men and women were about equally represented in the total abdominal operations.

The majority of patients whose wounds disrupted were between 40 and 60 years old. The youngest patient was 4 and the oldest 72 years of age.

Malignancy has been emphasized as a predisposing factor by many authors; that it acts in this capacity is demonstrated well in our series of cases. There were 6 eviscerations in patients operated upon for malignant disease; they comprised 27 per cent of the total eviscerations. In 582 laparotomies for malignancy, there were 6 eviscerations (1.20 per cent), in 2,345 operations for non-malignant diseases there were 16 eviscerations (0.67 per cent). Thus in this series, evisceration occurred twice as often in malignant diseases.

Of the 16 eviscerations in the non-malignant cases 6 followed cholecystectomies, 3 for acute and 3 for chronic cholecystitis. The 10 other eviscerations were associated with operations for the following conditions: peptic

TABLE V.—CASES OF DISRUPTION

No. Sex Age	Diagnosis	RBC	HGB	WBC	Debility	Jaundice	Blood pressure	Arteriosclerosis	Syphilis	Diabetes	Operation	Incision	Suture material	Cigarette drains	Disrupted P. O. days	Contributing factors	Secondary closure	Discharged P.O. days	Died P.O. days	Follow-up	Hernias
102253 M 47	Cholecystitis, acute	4.1	90	5,600	o	o	154/96	o	?	o	Cholecystectomy	U.R.R.	Cg	1	11	1. Vomiting 2. Cough 3. Ascites	Sw	44	*	Died 6 mos. later. Cirrhosis liver	
66342 M 57	Cholecystitis, acute	5.0	85	16,000	o	o	160/110	o	o	o	Cholecystectomy	U.R.R.	Cg	3	6	1. Stay sutures removed too early 2. Cough	Sw	27			Large, in 3 mos.
58189 M 49	Cholecystitis, chronic	5.7	90	9,600	o	o	110/70	o	o	o	Cholecystectomy	U.R.R.	Cg	2	11	1. Cough 2. Bile drainage 3. Infection	Sw	52			Large, in 18 mos.
118767 M 43	Cholecystitis, chronic		100	9,300	o	o	140/100	o	o	o	Cholecystectomy	U.R.R.	Cg	1	6	1. Distention 2. Vomiting	Sw		5	Autopsy *	
27433 M 72	Duodenal ulcer	3.3	70	6,600	++	o	120/70	sl	o	o	Gastric resection, partial	Tr.R.	Cg	o	7	Vomiting	Sw	29		30 mos. p.o. o.k.	None
125523 F 61	Carcinoma pancreas	4.8	90	12,600	+	o	108/68	sl	o	o	Posterior gastro-enterostomy	U.R.R.	Cg	o	5	Vomiting	Sw		63	Autopsy *	
103836 M 47	Carcinoma colon	3.1	50	8,000	++	o	145/80	sl	4+	o	Ileocolostomy	U.L.R.	Cg	o	7	1. Cough 2. Vomiting 3. Broken stay sutures	pack adh		40	No autopsy	
51193 M 45	Carcinoma colon	4.4	75	11,000	+	o	120/80	o	o	o	Ileocolostomy	M.L.R.	Cg	o	5	1. Infected wound 2. Distention	Sw		3	No autopsy	
77595 M 69	Diverticulitis colon	5.0	102	4,800	+	o	140/80	sl	o	o	Exploration colostomy	L.R.R.	Cg	o	8	Cough	Sw	31			
86074 M 52	Carcinoma rectum	5.9	108	8,800	o	o	125/45	sl	o	o	Exploration colostomy	L.L.R.	Cg	o	9	1. Distention 2. Vomiting	Sw		7	Autopsy	
102736 M 47	Postoperative ventral hernia	5.0	90	9,000	o	o	140/95	o	o	o	Repair of ventral hernia	U.R.R.	Cg	P	5	1. Distention 2. Vomiting		25			*
2450 M 46	Cholecystitis, chronic	4.3	90	8,300	o	o	150/90	o	o	o	Cholecystectomy	U.R.R.	Slk	o	6	?	Sw	32			None
57708 M 57	Carcinoma stomach	3.3	53	9,300	++	o	145/80	sl	o	o	Exploration inoperable carcinoma	U.R.R.	Slk	o	6	Unco-operative	Sw	24		Died 22 days later	
40677 M 38	Pancreatitis	4.2	72	9,100	o	o	130/82	o	o	o	Exploration	U.R.R.	Slk	o	6	1. Vomiting 2. Peritonitis	Sw		1		
84845 M 51	Bleeding from gastro-intestinal tract	4.8	78	7,800	++	o	130/80	o	o	o	Exploration	L.L.R.	Slk	o	7	1. Infection 2. Cough	Sw	56			None
74723 F 4	Appendicitis, peritonitis	4.8	90	22,000	o	o	80	o	o	o	Appendectomy	McBur.	Slk	5	2	1. Removal drain 2. Vomiting	Sw		1	Autopsy	

*This secondary closure was accomplished with silkworm gut.

TABLE V.—CASES OF DISRUPTION—Continued

No. Sex Age	Diagnosis	R B C	H G B	WBC	Debility	Jaundice	Blood pressure	Arterio-sclerosis	Syphilis	Diabetes	Operation	Incision	Suture material	Cigarette drains	Disrupted P.O. days	Contributing factors	Secondary closure	Discharged P.O. days	Died P.O. days	Follow-up	Hernias
56736 M 52	Ulcerative colitis	3.6	59	6,700	++	0	110/67	0	?	0	Mikulicz, ileum	L.R.R.	Slk	0	1	Inadequate closure	slk		5	Autopsy	
93513 M 38	Postoperative ventral hernia	4.5	84	10,800	0	0	140/100	0	0	0	Repair of ventral hernia	U.R.R.	Slk	0	9	Unco-operative, stood up	Sw	67			None
119702 M 53	Cholecystitis, acute			9,500	0	0	165/105	0	0	0	Cholecystectomy	U.R.R.	Sw	2	3	Wire untwisted	Sw	27			None
39218 M 72	Gastric ulcer	4.0	70	6,000	++	0	136/80	sl	0	0	Posterior gastro-enterostomy	U.R.R.	Sw	0	16	Bronchitis; sutures all out 16th day	Sw		2	Autopsy	
25886 M 51	Gastric ulcer	4.1	70	9,000	++	0	120/70	0	0	0	Gastric resection, partial	U.L.R.	Sw	0	10	Bronchitis; broken wires	Sw	19		Seen after 2 yrs.	None
53928 M 58	Carcinoma colon	2.5	40	20,000	+++	0	140/70	sl	0	0	Exploration carcinoma; abscess	U.R.R.	Slk Wg.	2	6	1. Infected wound 2. Distention	Pack. adh.		1	Autopsy	

*This secondary closure was accomplished with silkworm gut.

ulcer, 3; postoperative hernia, 2; ulcerative colitis, 1; diverticulosis of the colon, 1; bleeding from the gastro-intestinal tract, 1; appendicitis with peritonitis, 1; and pancreatitis, 1.

Operations for malignant diseases and for disturbances of the biliary tract together were responsible for 12 eviscerations, 54.5 per cent of the total number.

Debility long has been recognized as a possible cause of evisceration. It was present as evidenced by loss of weight, anemia etc., in 11 of the 22 cases. As one might expect, it was confined largely to the patients with carcinoma, bleeding ulcer, or chronic debilitating diseases such as ulcerative colitis. The red blood cell counts ranged from 2.5 to 5.9 million and the hemoglobin from 40 to 108 per cent. In all but one of the patients classified as debilitated, the hemoglobin was below 80 per cent; while in all save one of the others it was above 80 per cent. However, these figures for hemoglobin fail to give a true index, for they represented the last count obtained before operation, after every means of raising the hemoglobin by transfusions etc., had been exhausted.

Although the blood pressure was slightly elevated in a few of the cases and definite arteriosclerosis was noted in 8, both were in keeping with the average for this age group.

This series of cases is remarkable because in no instance was jaundice or diabetes associated with the evisceration although these conditions have been encountered frequently in the surgical cases in this clinic.

There was one patient with a history of syphilis and a 4+ Wasserman reaction. In 2 others the serology was questionable. Aside from these, lues played no part.

It will be seen in Table V that evisceration occurred 13 times in upper right rectus incisions; twice in upper left rectus incisions; once in a transverse rectus incision; once in a mid left rectus; once in a McBurney; twice in lower left rectus; twice in lower right rectus incisions. It is interesting to note that the single transverse rectus incision disrupted 7 days after operation.

An attempt has been made to discover a connection between evisceration and the type of suture material used. Of the 22 eviscera-

tions 11 were in wounds closed with catgut; 7, with silk; 3, with through-and-through silver wire; and 1, with through-and-through silkworm gut.

Drains were used in 8 cases, 5 of which were gall-bladder operations, 1 an appendix, 1 a carcinoma of the large bowel with abscess, and 1 a ventral hernia. The 14 remaining were closed without drainage.

The disruption occurred from 1 to 16 days after operation, the majority on the fifth to eleventh days after operation.

Occupying prominent positions among contributing factors were vomiting, 8; coughing, 6; distention, 5; and lack of co-operation, 2. It is well known that patients with stormy postoperative courses complicated by distention and vomiting necessitating gastric lavage, and by bronchitis with cough, are more likely to eviscerate. At the same time we find eviscerations among patients who presented none of these postoperative complications.

Secondary closures were effected in 18 of 22 cases with through-and-through silver wire sutures. None of these reopened. In 2 cases the wounds were packed and strapped with adhesive; in the 2 remaining the wounds were resutured.

Following secondary closure the patients remained in the hospital from 19 to 26 days.

The immediate mortality in this group of cases was 10 in 22 cases, or 45.45 per cent. This death rate corresponds closely to figures reported by other authors. White records 16 deaths in 30 cases; Meleney and Howes, 22 deaths in 50 cases (53 per cent and 44 per cent, respectively). Of the 22 cases suffering disruption 40.9 per cent died within 7 days of the secondary closure. Four died within 24 hours; 1 on the second day; 1 on the third day; and 2 on the fifth postoperative days. One death occurred 7 days after the secondary closure. Without exception the evisceration was definitely the cause of the immediate death. The majority of the patients, although failing to make the usual progress after operation, showed no definite failing until the wound gave way. From that time on their course was invariably unfavorable.

A follow-up of the cases discharged from the hospital after the secondary closure, showed that 1 died 8 months later of cirrhosis of the liver and another 22 days later as the result of cancer. There are 2 patients with definite postoperative hernias occurring 11 and 18 months respectively after operation, whereas 6 are not found to have hernias on revisits 10 days to 2 years after discharge from the hospital.

CONCLUSIONS

It cannot be said that very definite conclusions have been reached by this study in regard to the problem of evisceration. In all probability, the solution of the problem rests not in any one factor but in a number of different ones. It is suggested by the review of cases that closure of the abdomen should be accomplished by means of silver wire through-and-through sutures in a larger number of suitable cases. When malignancy is associated with infection, as in the resection of any portion of the gastro-intestinal canal, silver wire would seem to be the suture material of choice.

All wounds which are grossly infected and in which silver wire closure is not indicated, should be closed with catgut. Silk sutures should be used in clean wounds only.

Silk and catgut should not be used in the same wound.

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ANALGESIA, ANESTHESIA AND THE NEWBORN INFANT

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PRESENT methods of obstetrical analgesia are not ideal in their effects upon the mother (2), and none is without some unfavorable influence upon the fetus. Although these methods are not perfect, certain of them do give as high as 84 per cent complete maternal amnesia. The ultimate fate of present methods of analgesia may well hinge on the price the infant must pay for the mother's comfort. Modern obstetrical analgesia is accomplished by the skilful blending of various agents—thus pentobarbital, scopolamine, rectal ether and nitrous oxide-oxygen-ether may all be combined during one method of analgesia. The present study is a critical analysis of the influence of the various combined methods of analgesia and of their component parts upon the condition of the infant at birth.

A multitude of factors contribute to the condition in which the infant is found at birth (Chart 1). That the influence of analgesia or anesthesia may be determined, as many as possible of the other complicating influences must necessarily be eliminated or controlled. To this end the effect of various methods of analgesia has been observed in comparable groups (Table I) of normally delivered, full term, vertex presentation infants. All cases of operative delivery, breech extraction, internal podalic version, premature separation of the placenta, placenta prævia or congenital abnormality of the fetus have been excluded from this investigation. With the exception of the control group that received no medication of any kind, every case received nitrous oxide-oxygen, with or without less than an ounce of ether, for an average of 30 minutes and one of the basic analgesics.

This is the eighth in a series of studies of the newborn infant death rate from the Boston Lying-in Hospital, the Departments of Obstetrics and Pediatrics of the Harvard Medical School and the Department of Child Hygiene of the Harvard School of Public Health. This study was made possible through the generosity of Mrs. Albert C. Burrage.

PHYSIOLOGY

The normal physiology of the fetus and the newborn. The effect of analgesia and anesthesia upon the fetus and the newborn must be expressed in terms of the observed variation from the expected normal behavior. This being the case, the normal physiology of the fetus and the newborn is reviewed briefly so that the findings of this study may be more intelligible.

The animal and, we believe, the human fetus make rhythmical respiratory movements *in utero* (7). When the fetus is removed from the fluid medium the established respiratory rate continues and the animal "breathes and develops quite normally" (5). This conception is quite different from the belief previously held that the respiratory mechanism lies dormant *in utero* and at birth some physical or chemical stimulus is required to initiate the first respiration.

The full term human fetus *in utero* exists normally in a state of cyanosis with a mean capillary oxygen unsaturation of 11.1 volumes per cent (3) (the threshold for visible cyanosis being at 6.5 volumes per cent). The normal fetus at birth, due to impairment of placental circulation by the retracting uterus, is in an even greater state of cyanosis with a capillary unsaturation of 13.9 volumes per cent. At birth the arterial blood of the fetus contains less oxygen than the blood in the maternal arm vein.

The normal fetus, therefore, exists *in utero* with a low oxygen content in its blood and in a constant state of cyanosis. This cyanosis becomes most marked at the moment of birth. Cyanosis must be considered the normal state for the infant at delivery and becomes pathological only if unduly prolonged. The normal fetus makes rhythmical respiratory movements *in utero* and, coincident with the termination of placental circulation at birth, we expect the normal infant to continue

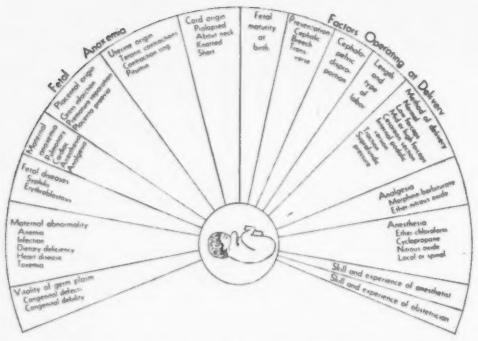

Chart 1. Factors influencing the condition of the infant at birth.

this respiratory rhythm spontaneously as extra-uterine breathing. In the present study an infant who fulfills the requirements of this paragraph is placed under the classification of "physiologically normal at the time of delivery."

The abnormal physiology of the fetus and the newborn. Intra-uterine anoxemia of the human fetus, whatever its cause, is accompanied by an accumulation of lactic acid in the fetal blood proportional to the degree of anoxemia (4). In extreme cases the amount of lactic acid accumulated may reach a point incompatible with life. In less severe degrees of anoxemia the respiratory rhythm of animal fetuses first become slowed and the heart rate is accelerated. In the presence of a marked degree of anoxemia respirations stop, "the blood pressure slowly declines through 40 to 60 seconds. It then may show a slight increase, but finally falls rapidly through two to three minutes, then more slowly for one or two minutes until a systolic pressure of 15 to 20 millimeters mercury is reached. Concomitant with the drop in blood pressure the skin becomes blanched and cold, as in a shock. . . . If the fetuses are delivered at term under these circumstances, the onset of respiration either fails or is much delayed." (6).

Physical injury to the fetus, either through cerebral edema or hemorrhage, may affect the central nervous system centers directly and result in a clinical picture at birth much the same as that which is found in intra-uterine anoxemia.

Certain drugs, such as ether, morphine, quinine, and the barbiturates, when administered in doses of sufficient amount to the pregnant animal will retard and at times arrest the respiratory movements of the fetus *in utero* (7).

The effect of abnormal factors may be evidenced by the death of the fetus *in utero* or at the time of delivery, by more or less difficulty in establishing the infant's extra-uterine breathing and by an unusual prolongation of the cyanotic state of the newborn. They may be evidenced by a pallid state at the time of birth and by the absence of muscular tone.

TABLE I

Primary medication	Secondary medication	Cases	Vertex presentation %	Normal deliveries %	Parity Av.	Age Av.	First stage—av. hrs.	Second stage—av. hrs.	Ruptured membranes to birth—av. hrs.	Primary medication—av. grs.	Scopolamine—av. grs.	Rectal ether—av. oz.	Gas oxygen—av. min.	Ether—av. oz.
None	None	53	100	100	5	30	10	2	3	0	0	0	0	0
Pentobarbital	Scopolamine	50	100	100	2.6	27	10	0.7	6	7.2	1/87	0	30	0.7
Pentobarbital	Rectal ether	50	100	100	2.4	26	13	0.9	5	7.0	0	2.7	27	0.3
Pentobarbital	Scopolamine Rectal ether	35	100	100	1.7	27	18	1.5	9	8.1	1/118	2.1	30	0.8
Pentobarbital	Paraldehyde	50	100	100	2.4	27				7.6	0	0	28	0.6
Sodium amytal	Scopolamine	50	100	100	2.5	28	12	0.7	6	11.8	1/50	0	26	0.8
Sodium amytal	Rectal ether	25	100	100	2.5	28	11	0.6	4	12.3	0	2.8	24	1.1
Pernocton		50	100	100	2.5	27	15				0	0	26	0.3
Pantopon	Scopolamine	50	100	100	2.8	27	15	0.7	5	1/3	1/43	0	27	1.0
Pantopon	Rectal ether	25	100	100	2.6	26				½	0	2.5	24	1.1
Morphine	Mag. sulphate	25	100	100	3.0	26	13	0.6	5	¼	0	0	29	1.0

THE EFFECT OF OBSTETRICAL ANALGESIA OR ANESTHESIA UPON THE LIFE OF THE FETUS AND NEWBORN

Obstetrical analgesia or anesthesia by means of a combination of pentobarbital or sodium amytal with terminal nitrous oxide-oxygen or nitrous oxide-oxygen-ether inhalation has been used with increasing frequency at the Boston Lying-in Hospital since 1931. Up to 1933 sodium amytal was in use but since this time practically every routine hospital delivery has received pentobarbital with or without scopolamine or rectal ether.

With this extensive use of the barbiturates, any fatal effect of the drug would have to be reflected in an increased stillbirth and neonatal mortality rate. These rates for a 5-year period preceding and for a like period following the introduction of barbiturate analgesia in 1931 are given in Chart 2. The stillbirth rate has fallen from 65 in the prebarbiturate era to 56 per 1000 births for the past 5 years. The neonatal mortality rate was 22 for the period prior to 1931 and 19 per 1000 births for the 5 years following.[1] It would appear from these figures that the general use of sodium amytal and pentobarbital in this clinic has had no ill effect on the life of either the fetus or the newborn infant.

In contrast to the statement just made, we issue a warning against the use of any analgesic containing an opium derivative. The only 2 deaths encountered in the 410 cases comprising this study occurred in the 75 receiving pantopon. Evidence that is to follow will demonstrate the alarming symptoms that have followed the use of morphine or pantopon. In a previous communication (1) it was

[1] May 26, 1937. The neonatal mortality for the year 1936 was 13 per 1000 births.

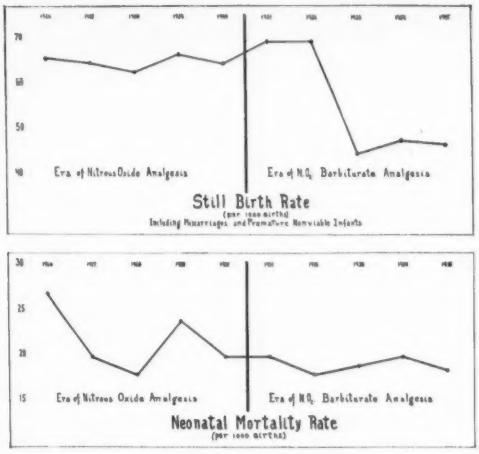
Era of Nitrous Oxide Analgesia
Era of N.O. Barbiturate Analgesia
Still Birth Rate
Including Miscarriages and Premature Nonviable Infants
Era of Nitrous Oxide Analgesia
Era of N.O. Barbiturate Analgesia
Neonatal Mortality Rate

Chart 2.

shown that the use of morphine within 4 hours of the birth of a premature infant was associated with a doubling of the death rate. It was also demonstrated that the larger the dose of the drug the higher was the associated mortality. In view of these facts one can but assume that the use of this type of analgesia on a large scale would result in an increase in the stillbirth rate and as well the neonatal mortality rate.

MORPHINE AND PANTOPON VERSUS SODIUM AMYTAL AND PENTOBARBITAL—TABLE II

A. Their relative efficiency as maternal analgesics and their effect upon the normal physiology of the newborn. Of the mothers receiving sodium amytal or pentobarbital as a basic analgesia 78 per cent had absolutely no memory of their labor compared with 34 per cent of those receiving morphine or pantopon.

TABLE II

	No anesthesia	Pentobarbital-sodium amytal	Morphine-pantopon
Cases	53	260	100
Type of labor			
Easy—per cent		78	34
Moderately easy—per cent		13	24
Moderately hard—per cent		5	24
Hard—per cent		4	18
Condition of infant at birth			
Physiologically normal—per cent	73	63	43
Active resuscitation required—per cent	0	3	23
Abnormal cyanosis—per cent	23	23	38

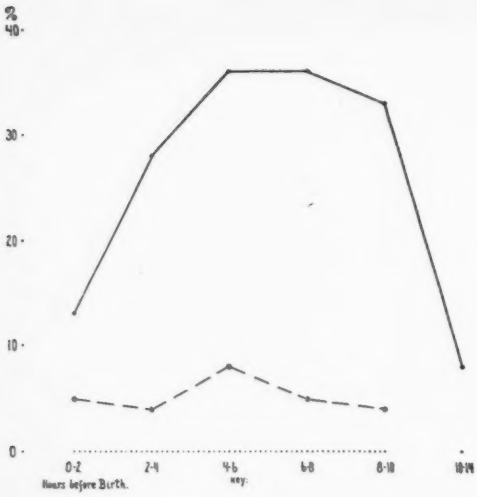

Chart 3. ————, morphine-pantopon
— — —, pentobarbital-sodium amytal
. . . . . ., control—no medication

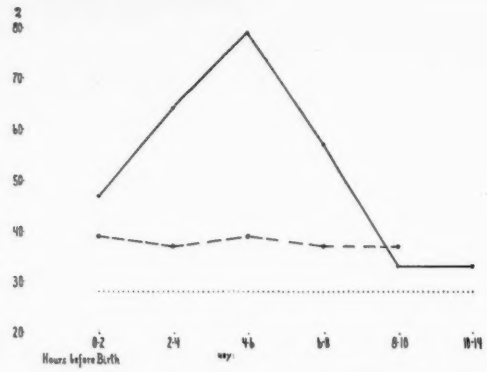

Chart 4. ————, morphine-pantopon
— — —, pentobarbital-sodium amytal
. . . . . ., control—no medication

In the pentobarbital-sodium amytal group, 63 per cent of the infants were physiologically normal at birth as opposed to 43 per cent of the morphine-pantopon series.

An active method of resuscitation, such as tubbing, mouth to mouth, or the use of a respirator, was required for 3 per cent of the barbiturate group and for 23 per cent of the morphine-pantopon cases.

Abnormally prolonged cyanosis was present in 23 per cent of those receiving barbiturates and in 38 per cent of those given an opiate.

Two infant deaths occurred in the pantopon series and none in the barbiturate.

B. The relation between the time interval from medication to birth and the condition of the infant at delivery (*Chart 3*). In an effort to detect the slightest effect of medication upon the fetus every case in which extra-uterine respiration did not begin spontaneously and independently at birth has been classified as physiologically abnormal. This definition has been so rigidly applied that resuscitation by such simple means as suction and spanking has been sufficient to exclude the infant from the normal group.

In the case of morphine and pantopon a definite relation exists between the time interval from medication to birth and the number of physiologically abnormal infants at delivery (Chart 3). Medication given to the mother less than 2 hours before birth is associated with some degree of abnormality in 47 per cent of the infants. This latter figure increases to a peak of 79 per cent abnormality in the group receiving medication 4 to 6 hours prior to the time of birth and then falls to 33 per cent when the time interval becomes 8 hours or more.

This relationship does not exist in the case of sodium amytal or pentobarbital medication (Chart 3). The rate of physiologically abnormal infants is fixed between 37 and 39 per cent whether the drug is given 2 or 10 hours before actual birth.

The more usual method of appraising the effect of maternal medication upon the fetus is to record the number of infants requiring active and vigorous methods of resuscitation (Chart 4). Again a definite relation is found to exist between the time of medication with morphine or pantopon and the number of infants requiring resuscitation by methods of artificial respiration. Thirteen per cent of infants whose mothers received morphine or pantopon within 2 hours of their birth required artificial respiration. Thirty-six per cent required active resuscitation when the drug was given 4 to 8 hours before delivery and 8 per cent when medication was 10 hours or more before birth.

Again it should be emphasized that no relation between the time of medication and the incidence of cases requiring artificial resuscitation could be demonstrated in the case of analgesia with the barbiturates.

C. The relation between the size of the dose and the condition of the infant at birth. The relation between the size of the dose of morphine or pantopon and the condition of the infant at birth cannot be determined from the present study since each patient received the same dose, 1/3 grain of pantopon or 1/4 grain of morphine sulphate, and in no case was the dose repeated. From an earlier study it was found that the premature infants of mothers receiving morphine within 4 hours of delivery encountered twice the death rate of infants whose mothers had not received the drug (1). It was also shown that the death rate increased as the size of the maternal dose increased.

The average pentobarbital medication in the present study was 7.5 grains. Of the group receiving 6 grains or less, 40 per cent of the infants were considered physiologically abnormal compared with 39 per cent of the group receiving 9 grains or more.

The average sodium amytal dosage was 12½ grains. Of the group receiving 9 grains or less 36 per cent were thought to show some variation from the normal whereas in the series receiving 15 grains or more 32 per cent failed to breathe spontaneously the moment delivered.

A definite relation is thought to exist between the size of the dose of morphine administered and the condition of the infant at birth, but no relation is demonstrable between the size of the barbiturate dose and the state of the newborn.

TABLE III.—COMPARISON OF MORPHINE-PANTOPON AND BARBITURATE ANESTHESIA

	Morphine-pantopon	Barbiturate
Complete maternal amnesia	34%	78%
Deaths in this series	2	0
Artificial resuscitation required	23%	3%
Infants physiologically normal at birth	43%	63%
Does a definite relation exist between time of medication and condition of infant?	Yes	No
Does a definite relation exist between size of dose and condition of infant?	Yes	No

A review of the case of morphine-pantopon vs. barbiturate basic analgesia recalls the points as given in Table III.

In the light of these facts the use of morphine or pantopon as a method of obstetrical analgesia would appear to be not only unsatisfactory for the mother but dangerous to the infant.

THE COMBINATION OF SCOPOLAMINE, RECTAL ETHER OR PARALDEHYDE WITH THE BARBITURATES

The effect of combining scopolamine, rectal ether, or paraldehyde with the basic pentobarbital or sodium amytal analgesia has been analyzed in Table IV. When scopolamine is combined with either pentobarbital or sodium amytal a more successful obstetrical analgesia results in so far as complete maternal amnesia is concerned. The addition of this drug has not resulted in any significant change in the condition of the infants at birth. However, the combination of rectal ether or paraldehyde with the basic analgesia cannot be demonstrated to exert an unfavorable influence upon

TABLE IV

Basic analgesia	Secondary analgesia	Maternal amnesia %	Infant				
			Normal at birth %	Artificially resuscitated %	Abnormally cyanotic %	Minutes to first breath	Minutes to first cry
None (Control series)	None	0	73	0	23	1	2
Pentobarbital	Scopolamine	90	62	2	26	0.8	4.0
	Rectal ether	78	58	2	22	0.8	4.9
	Scopolamine rectal ether	83	69	3	15	0.5	5.0
	Paraldehyde	60	64	4	24	0.6	4.0
Sodium amytal	Scopolamine	82	58	8	26	0.8	3.0
	Rectal ether	72	70	0	26	0.5	4.4
Pernocton	None	44	66	6	40	0.7	5.4

the condition of the infant at birth; such addition does not result in a more successful maternal analgesia.

PERNOCTON ANALGESIA

Pernocton (Table IV) was used intravenously in 50 cases but did not produce as successful maternal amnesia as did pentobarbital or sodium amytal. The infants under this medication reacted about the same as those under the oral barbiturates with the exception that more abnormal cyanosis was encountered.

THE EFFECT OF NITROUS OXIDE AND ETHER UPON THE NEWBORN INFANT

In this study every case, except the controls, received nitrous oxide and oxygen during the second stage of labor (Table I)—the average length of administration being 30 minutes. Of the patients receiving gas-oxygen for 30 minutes, 63 per cent of the infants breathed spontaneously on delivery; the series receiving gas-oxygen from 30 to 60 minutes had 62 per cent normal infants while those from 60 to 120 minutes are recorded as having 63 per cent infants unaffected. In other words, the length of administration of nitrous oxide analgesia seems to bear no relation to the condition in which the infant is found at birth. Unfortunately, the concentrations of nitrous oxide and oxygen administered to the individual have not been recorded and the relation of this important factor to the infant's condition cannot be given from our material. The conclusions of Eastman (6) on this subject are important: "Nitrous oxide mixtures, administered to mothers in proportions of 85:15 or weaker, and for periods of less than 5 minutes, regularly cause moderate degrees of fetal anoxemia but the normal, full term infant is apparently not harmed. When nitrous oxide oxygen is given in concentrations of 90:10 or stronger over periods which exceed 5 minutes, marked degrees of fetal anoxemia are produced in about one baby out of three and occasionally profound asphyxia neonatorum results."

The average patient in our study received less than 1 ounce of ether combined with the nitrous oxide-oxygen mixture (Table I). One hundred and two patients received no ether and 57 per cent of their infants were classified as physiologically normal at birth. One hundred and eighty-three received ether mixed with gas-oxygen and 66 per cent of their infants were entirely normal at birth. This small amount of ether certainly exerted no harmful effect on the fetus.

ANALGESIA VERSUS NO ANALGESIA

Since we believe analgesia containing an opium derivative should not be used the basic question resolves itself into barbiturate analgesia versus no analgesia. We have found little to choose between sodium amytal and pentobarbital but since the latter seems to be safer for the mother and to have slightly less effect on the baby it is the one in general use in our clinic. The comparison, therefore, is to be between delivery without analgesia and delivery under the combination of pentobarbital-scopolamine-rectal ether-nitrous oxide oxygen ether. The effects of these two systems, in so far as statistics can give them, are compared in Table V.

TABLE V

	No analgesia	Pentobarbital-scopolamine-rectal ether-nitrous oxide oxygen analgesia
Maternal amnesia	0	84%
Fetal mortality	0	0
Neonatal mortality	0	0
Infants physiologically normal	73%	62%
Infants artifically resuscitated	0	2%
Infants abnormally cyanotic	23%	21%
Minutes to first breath	1.0	1.0
Minutes to first cry	1.6	4.7

What is indicated but not brought out already in this statistical comparison is the clinical fact that the analgesia baby is a dopey or sleepy baby. It is true that they usually gasp shortly after delivery but the respirations are shallow and frequently after the first breath a considerable period may elapse before normal respiration is established. Their muscles are relaxed and they are limp; as the Table V shows, an average of 5 minutes passes before they cry. An average of 2 per cent requires some method of artificial resuscitation before respiration becomes normal. As has been demonstrated by the fall in the stillbirth and neonatal mortality rates these symptoms,

while annoying or even alarming at times, are not serious—they are the price paid for analgesia. If analgesia is used, they must be expected, understood, and treated.

DISCUSSION OF THE FACTOR IN ANALGESIA RESPONSIBLE FOR THE SYMPTOMS OBSERVED IN THE NEWBORN

A. Pentobarbital or sodium amytal. We have been able to demonstrate no relationship between either the size of the dose or the time of administration of the barbiturates and the condition of the infant at birth.

B. Scopolamine, rectal ether or paraldehyde. We have been unable to prove an effect on the infants attributable to the doses used of scopolamine, rectal ether or paraldehyde.

C. Inhalation ether. The average patient having received less than 1 ounce of ether inhalation it is perhaps understandable that we have been able to show no effect on the infant.

D. Nitrous oxide-oxygen. There was no relation found between the duration of gas oxygen administration and the infant's condition.

As has been previously stated the factor about which we have had no information is the concentration of the nitrous oxide-oxygen mixture used. Eastman's demonstration that high concentrations of nitrous oxide will produce severe anoxemia of the fetus emphasizes the importance of this factor. He advises a mixture no greater than 85:15 even in operative obstetrics and the addition of ether to this mixture if necessary. With attention thus called to the marked influences on the fetus of high concentration of nitrous oxide, future experiences with analgesia may be more successful than that here recorded.

SUMMARY

Opium derivatives administered during labor have been found to exert an unfavorable influence upon the condition of the newborn infant proportional to the amount given and to the time interval between the administration of the drug and the birth of the child. In this group 57 per cent of the infants required some stimulation before they would breathe and cry normally and 23 per cent were asphyxiated to the point of requiring artificial resuscitation. Successful maternal amnesia was obtained in but 34 per cent of the cases.

The barbiturates have had no harmful effect upon either the life of the fetus or upon the life of the newborn infant. Over 10,000 mothers have received sodium amytal or pentobarbital in the past 5 years, and during this interval both the still birth and the newborn infant death rates have fallen below the level of the preceding 5 years. Following analgesia through a combination of barbiturate, scopolamine, rectal ether, nitrous oxide-oxygen and small amounts of ether 37 per cent of the infants required some stimulation before normal respirations were established while 31 per cent were sufficiently asphyxiated to require artificial resuscitation. Complete amnesia was obtained for 78 per cent of the mothers in this group.

Neither pentobarbital, sodium amytal, scopolamine, rectal ether nor paraldehyde could be held responsible for the symptoms of asphyxia that were encountered in some of the newborn infants. It is our belief that the untoward effects of analgesia may well be explained by nitrous-oxide-oxygen mixtures above the 85:15 level producing a degree of fetal asphyxia dependent upon the duration of the exposure and the size of the infant.

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PSEUDOMENSTRUATION IN THE HUMAN FEMALE

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THE conception that normal menstruation is the result of rhythmic dismantling of an estrin-primed and progestin-modified endometrium has not changed since the recognition of a correlation between the ovarian and endometrial cycles by Robert Schroeder (25) in 1913. Our newer knowledge of the physiology of menstruation has merely established the biochemical nature of the two ovarian hormones, estrin and progestin, which successively activate the endometrium in preparation for nidation of the fertilized ovum.

The immediate cause of the dismantling process of menstruation upon failure of fertilization is still conjectural. According to Allen, a decrease in estrin production resulting from the cyclic regression of the corpus luteum is the chief exciting factor of menstrual bleeding. This theory is strongly supported by the recent experimental observations of Smith on the effect of 10 daily injections of from 400 to 500 rat units of estrogenic substance in hypophysectomized rhesus monkeys. Uterine bleeding, indistinguishable from the normal anovular type, appeared in 8 of 10 test animals after withdrawal of the treatment. Two additional hypophysectomized animals, similarly treated with estrogenic substance and then given 2 rabbit units of progestin daily for a period of 10 days, menstruated from a progestational endometrium 3 days following the last injection. Since pituitary ablation invariably results in total suppression of ovarian function, Smith's recent work seems to indicate that withdrawal of estrin influence is the exciting if not the sole cause of menstrual bleeding and that the hormone, whether derived from the graafian follicle or corpus luteum, supplies the essential mechanism of the non-secretory type of menstruation.

The ability of progestin to delay the onset of menstruation in normal and estrin-treated castrated rhesus monkeys (8) does not necessarily imply that the absence of the hormone, when the corpus luteum regresses, is the exciting cause of menstrual bleeding—no more than the ability of progestin to inhibit uterine motility (9) implies that the latter is caused by an absence of the hormone. Uterine motility, like uterine bleeding, is totally independent of progestin in its active phase.

In the human female, the individual and combined effects of the two ovarian hormones were amply demonstrated by Kaufmann, Clauberg, and others through the successive administration of estrogenic substance and progestin in castrated women. Estrin rebuilds the dismantled endometrium following menstruation; progestin modifies the estrin-primed endometrium in anticipation of fertilization. In the absence of extreme uterine atrophy, uterine bleeding, clinically indistinguishable from normal menstruation, follows estrin treatment of castrated and menopausal women (5, 32).

Concerning the possible occurrence of rhythmic uterine bleeding, clinically indistinguishable from the normal, from an endometrium totally lacking the secretory (progestin) phase, Schroeder (27) states: "There is a peculiar, seasonal phenomenon in apes (non-ovulatory bleeding of Hartman) which has not yet been described in humans unless one accepts the cases recently reported by Mazer and Ziserman. The report is not clinically convincing (lacks adequate description of the bleeding). However, a certain amount of evidence suggests that this may occur in human beings." Recognizing the justice of Schroeder's criticism, we have included in this study details unavoidably eliminated in the previous publication (20).

TERMINOLOGY: PSEUDOMENSTRUATION VERSUS ANOVULAR MENSTRUATION

The somewhat acrimonious debate between English and American gynecologists concern-

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ing the occurrence or non-occurrence of cyclic and otherwise clinically typical menstruation from an endometrium lacking the secretory phase is founded mainly on the false premise that the phenomenon invariably connotes failure of ovulation and luteinization. Novak (23), for instance, states: "Is there any way of determining whether or not a sterile woman is ovulating? This question can be answered in the affirmative. The most direct and logical method is through study of the endometrium just before an expected menstrual flow, assuming that the periods recur regularly. If ovulation has occurred, the endometrium will show the characteristic secretory changes evoked by the corpus luteum hormone (progestin). If, on the other hand, there is a complete absence of secretory changes, it may be assumed that there is no corpus luteum; i.e., that ovulation has not occurred." This statement is correct in its implication that the finding of a premenstrual endometrium justifies the assumption that ovulation and luteinization had taken place. It is unreasonable to assume, however, that the absence of the secretory phase in the endometrium obtained for examination premenstrually definitely indicates failure of ovulation and luteinization. Their absence in the human being may be suspected but cannot be proved without recourse to serial sections of both ovaries which are available in a normal state only in instances of accidental death during the premenstruum. Deductions drawn from autopsy or operative material are usually likewise inconclusive because the disease leading to the death of the patient or to a bilateral oophorectomy may have interfered with ovulation and luteinization. It will be shown later that, in the human female, factors other than failure of ovulation, such as an inherent or acquired lack of responsiveness of the endometrium or a quantitative disproportion of the two ovarian hormones, may enter into the etiology of this form of menstruation. Hence, the two terms, "anovular menstruation" and "pseudomenstruation," are not synonymous. When the diagnosis is based solely on endometrial findings, the term pseudomenstruation, originally suggested by Schroeder (26), is more appropriate.

TABLE I.—CONDITIONS WHICH LED TO VAGINAL OPERATIONS AND OPTIONAL CURETTAGE DURING THE PREMENSTRUUM IN 68 NORMALLY MENSTRUATING FERTILE WOMEN*

Indications for operation	Cases
Lacerations of birth canal	39
Prolapse of uterus	5
Dysmenorrhea	3
Retroversion of uterus	4
Cervical polyp	5
Chronic cervicitis	6
Pruritus vulvæ	1
Uterine fibroids	1
Cervical malignancy	1
Renal calculus and rectocele	1
Chronic appendicitis	1
Hemorrhoids	1
Total number of cases	68

*All but 1 showed the premenstrual phase.

THE INCIDENCE OF PSEUDOMENSTRUATION

The average cyclically menstruating woman of childbearing age shows a corpus luteum (secretory) phase in the endometrium after the sixteenth day of the beginning of her previous menstruation. We agree with Schroeder (27) that cyclic uterine bleeding at intervals of less than 21 days or a flow exceeding 8 days is evidently pathologic and is usually associated with follicle cystosis and endometrial hyperplasia.

That pseudomenstruation is rarely encountered in fertile or potentially fertile women is herein shown by a comparative study of endometrial tissues obtained by curettage premenstrually from 68 regularly menstruating fertile women in whom the procedure was optional and performed as a routine measure in the course of vaginal plastic operations (Table I). The patients ranged in age from 22 to 47 years with an average of 36.3 years. Each of them had borne 1 or more children, the average number was 3. The menstrual cycles of the 68 women ranged from 21 to 35 days; the average for the group was 29.8 days. The duration of the menstrual flow in these women varied from 3 to 7 days and averaged 5.4 days. Twelve of the 68 women (17.5 per cent) suffered from primary dysmenorrhea. The endometrial specimens from each of the 68 women were obtained from 2 to 7 days (average 4.7 days) prior to the expected menstruation. The endometria of all but 1 showed the secretory changes of the usual

premenstruum. The remaining patient exhibited the phenomenon of pseudomenstruation. She was 36 years old and a mother of 4 children, the youngest of whom was then 9 years of age. She was voluntarily sterile since the last childbirth. Her menstrual periods were always regular, at intervals of 28 days, the flow lasting 3 days. She enjoyed good health but was annoyed by a relaxed vaginal canal for which a plastic operation was performed on April 24, 1933, when menstruation was just beginning. The endometrium recovered at the time of the operation was of the interval type, without the slightest evidence of progestin effect.

The contention of Shaw that the secretory phase is invariably present in the endometrium of women who menstruate cyclically and not excessively is based on a study of a relatively small group of patients, none of whom was within the scope of functionally sterile but otherwise normal women upon whom we made our previous and present observations. Some of his 28 patients whose time of the menstrual cycle permitted comparative study were sterile, but all of them had uterine fibroids and "myohyperplasia" to account for the existing sterility.

In 1932 the senior author in collaboration with Dr. Ziserman (20) reported on the occurrence of pseudomenstruation in nearly 50 per cent of 41 regularly menstruating women who were sterile without any discernible cause. This was the first detailed report in the literature on the absence of the secretory phase in a considerable number of regularly menstruating women. Passing mention of the condition in the human being was previously made by Corner in 1927, Mazer and Hoffman (17) in 1929 and by Novak in 1930. In 1934, Anspach reported that, in his experience, 9 of 42 regularly menstruating women treated for sterility, dysmenorrhea, and obesity showed no evidence of the secretory phase in endometria obtained premenstrually. In most instances of the Anspach series, the endometrium was definitely hyperplastic. In the same year, Tietze (30) found endometrial hyperplasia and absence of the secretory phase in 5 women who were menstruating at normal intervals and not excessively. In 1935, Jeffcoate reported on the absence of the secretory phase in 10 of 21 cases of sterility "in the absence of any gross lesion or associated menstrual abnormality." In a few of these 10 patients he observed typical endometrial hyperplasia.

A more exhaustive study on the occurrence of pseudomenstruation in functionally sterile women was reported recently by Bland *et al.* Only 23 of their 50 regularly menstruating, functionally sterile patients, curetted premenstrually, showed the secretory phase. In 15 the endometrium was of the interval type; in 9 it was hyperplastic; and in the 3 remaining it was definitely atrophic. The studies of Anspach, Jeffcoate, and Bland, confined to the functionally sterile type of patients, confirm the original observations of Mazer and Ziserman on the high incidence of pseudomenstruation in regularly menstruating women who are sterile without an accountable cause other than an inadequate preparation of the endometrium.

One of us (11) has previously stressed the occasional presence of pseudomenstruation in patients suffering from primary dysmenorrhea. Recently Lackner and Krohn noted 4 instances of non-secretory endometria in a group of 16 regularly menstruating women suffering from dysmenorrhea. It seems that during the developmental period of puberty and adolescence, pseudomenstruation is also frequently present, accounting for the relative infertility even of those of the exposed girls under 17 years of age who menstruate regularly (21).

ETIOLOGY OF PSEUDOMENSTRUATION

Three independent factors may produce pseudomenstruation, namely, failure of ovulation (anovulatory menstruation), an inherent or acquired lack of uterine responsiveness, or a quantitative disparity in production of the two ovarian hormones.

The presence of endometrial hyperplasia which occurs in one-third of these patients points definitely to the first named etiological factor, namely; failure of ovulation and luteinization. This phenomenon is thus lucidly described by Tietze (31): "The human follicle-persistence with subsequent endometrial hyperplasia may be a periodic occur-

rence. I consider this a direct parallel to the non-ovulating bleedings of monkeys (summer cycle). It is assumed that in the ovaries of such cases follicles periodically ripen and, in the absence of ovulation, produce follicular hormone over too long a period and then become atretic. The mechanism is similar to that of apes and guinea pigs—periodic excess of follicular hormone but without protracted follicle-persistence as in women. The majority of such cases, usually presenting the quiet type of endometrial hyperplasia (i.e., simply an exaggerated proliferative phase), afford—some clinically, others anatomically—the deceptive information for menstruation without ovulation. In our opinion, this so called menstruation without ovulation is nothing more than bleeding from a pathologically proliferative endometrium. . . . Anatomically the bleeding arises from a necrotic proliferative endometrium, but it is always a pathological proliferative endometrium. The connoisseur will recognize this. There are no grounds, at present, either to give up or to revise the well grounded conception of menstruation and the duality of the cycle." We agree with Tietze that histologically the condition connotes an abnormal form of menstruation and have, in fact, repeatedly emphasized its interference with the normal process of conception. Pseudomenstruation is, however, *clinically* indistinguishable from the normal type of menstruation because the rhythm and duration of the bleeding are basically normal.

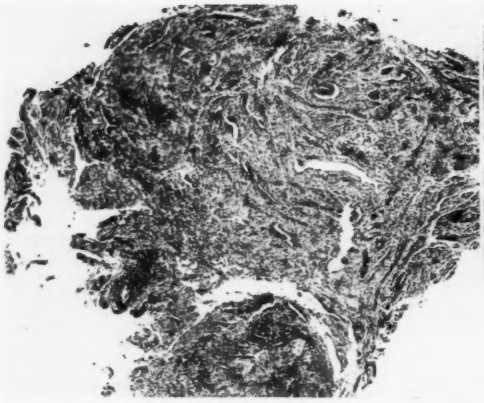
The second factor operative in the causation of pseudomenstruation is a developmental or acquired uterine defect which prevents the organ from responding to normal ovarian activity. It is characterized by atrophy of the endometrium obtained premenstrually despite the presence of a normal level of estrogenic substance in the blood and urine. Patients with such a defect usually show a marked degree of uterine hypoplasia which occasionally responds to huge doses of estrogenic substance, given repeatedly 1 week of the month only, to avoid pituitary inhibition (18).

A striking illustration of a purely uterine defect in the etiology of pseudomenstruation and associated sterility is the following:

E. B., aged 30 years, who has been menstruating regularly and not excessively since the age of 11 had been sterile without an apparent cause for several years. Her uterus was small, hard, and retroverted and her adnexa neither palpable nor tender. The Rubin test showed patency of the fallopian tubes at a normal pressure and the Huehner test indicated normal insemination of the cervical canal. The unmodified Frank and Goldberger test was positive and her 24 hour output of urine yielded 13.3 rat units of active estrogenic substance, indicating a fairly good ovarian activity. A uterine curettage, performed at the Mt. Sinai Hospital under gas anesthesia on September 20, 1934, only 4 days before her expected flow, recovered only a few fibrous shreds (Fig. 1). She was given hypodermically 22,000 rat units of progynon-B (dihydroxyestrin benzoate) in 3 divided doses during the early part of October. The following menstrual flow was profuse and appeared a week prematurely. We (19) have previously described this response of the uterus to relatively large doses of estrogenic substance. The patient was subsequently given 8,000 rat units of the same product in 4 divided doses and again curetted on November 7, 1934, 6 days before her expected flow. A considerable quantity of endometrium was obtained which on examination showed an early secretory phase with focal areas of hyperplasia (Fig. 2). She menstruated on time several days later and thereafter until March, 1935, when she conceived without additional treatment.

The presence of a marked uterine atrophy, despite a normal production of the follicular hormone, seems to point definitely to a uterine defect in the etiology of pseudomenstruation which, in this instance, was fortunately corrected by the administration of 2 courses of relatively large quantities of estrogenic substance. Inasmuch as the product does not stimulate the ovaries but exerts its influence on the muellerian tract, it is reasonable to assume that the pseudomenstruation and associated sterility were not due to failure of ovulation. We have seen instances of endometrial atrophy (in women suffering from primary amenorrhea and in castrates) in which the administration of as much as a half million rat units of estrogenic substance failed to produce the required endometrial growth preparatory to progestin administration by the Kaufmann technique.

The third probable cause of pseudomenstruation is a quantitative or qualitative disharmony between the two ovarian hormones, necessarily resulting in an inadequate preparation of the endometrium and suppression



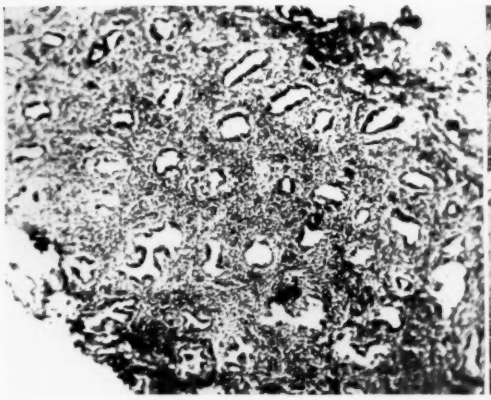
Figs. 1 and 2. Case 1. Illustrative of the uterine factor in the etiology of pseudomenstruation. The two specimens were obtained before and after treatment, respectively. Note the marked endometrial hypoplasia, despite the presence of a positive Frank and Goldberger test and 13.3 rat units of estrogenic substance in the 24 hour output of urine. The secretory phase with small areas of hyperplasia was present 2 months later after treatment with 30,000 rat units of estrogenic substance, the effect of which is known to be limited to the muellerian system. × 75.

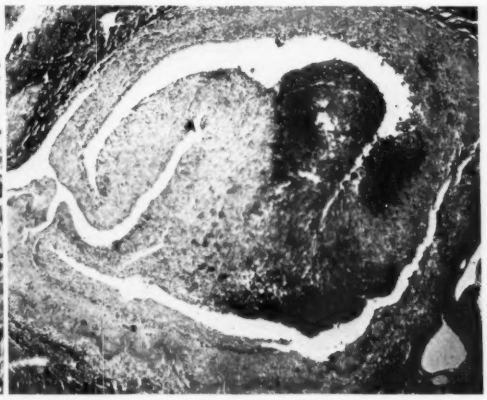
of the premenstrual phase. "It seems probable," states Bartelmez, "that all possible transitions occur between the ovulatory and anovular types, depending on the variability in potency of the hormones and in the susceptibility of the mucous membrane in different cases." In the experimental field, we find corroboration of this clinical observation when we employ the Clauberg method of standardizing progestin. Preliminary overtreatment or undertreatment of the infantile test rabbits with estrogenic substance nullifies the effects of the most potent progestin product. For accurate standardization, the two hormones must be administered in balanced quantities, first estrin and then progestin. These experimental observations of Courrier, Leonard, and others not only explain the different patterns of premenstrual endometria but also the occasional absence of the secretory phase in the endometria of women whose ovaries show definite evidence of recent luteinization. Illustrative of the latter phenomenon—absence of the secretory phase in the presence of recent luteinization—is the record of P. S., a functionally sterile woman, 23 years of age.

Since the menarche at 13 years her menses were regular and not excessive, recurring at intervals of from 21 to 25 days and lasting 7 days. The opportunity to perform a premenstrual curettage and examine the ovaries simultaneously presented itself during an operation for an exacerbation of chronic appendicitis. Her last menstrual period had occurred June 6, 1936. On June 29, 1936, just prior to the expected menstrual flow, a uterine curettage and an appendectomy were performed. During the laparotomy both ovaries were carefully inspected and a small, yellow cyst, grossly resembling a corpus luteum, was excised from the left ovary. The histological examination of the excised tissue revealed the presence of a fresh corpus luteum cyst (Fig. 4). The endometrium simultaneously obtained was definitely proliferative and entirely devoid of secretory changes (Fig. 3).

TREATMENT OF PSEUDOMENSTRUATION AND ASSOCIATED STERILITY

It is evident that successful treatment depends upon the correction of the underlying cause of the atypical menstruation. In the absence of uterine atrophy and the presence of a normal estrin content of the blood and urine, especially when the endometrium shows evidence of hyperplasia, failure of ovulation and luteinization may reasonably be suspected. We found this condition most refractory to treatment. The luteinizing principle obtained from the urine of pregnant women (antuitrin-S, follutein and APL anterior pituitary like substance), so effective in evoking ovulation in the experimental animal, is a total failure when applied clinically for this purpose





Figs. 3 (× 56) and 4 (× 21). Case 17. Photomicrograph of specimen illustrative of pseudomenstruation in the presence of a recent corpus luteum. Note the total absence of the secretory phase in the endometrium. Both specimens were obtained at the onset of menstruation.

(10). Insulin is probably the most effective treatment of anovulatory menstruation in slender, under-weight, non-diabetic women (16). It proved effective in 2 of our patients. In the obese patients, a diet high in proteins and low in fats and carbohydrates together with the judicious use of thyroid extract is indicated. The lack of essential vitamins in such a diet must be corrected by the administration of concentrates of cod liver oil. Operative measures, consisting of puncture or dissection of retained follicles or resection of portions of the cystic ovaries, coupled with cervical operations for the establishment of good drainage, are advocated by Reynolds and Macomber. Some of these patients respond to prolonged diathermy treatment which has a tendency to improve ovarian circulation.

In the atrophic type of pseudomenstruation, a purely uterine factor may be suspected if the blood and urine contain an adequate quantity of the follicular hormone. Large doses of estrogenic substance given intermittently, as described above, may correct the condition and enable the patient to conceive. In the absence of an adequate production of the follicular hormone, the uterine atrophy is evidently the result of an ovarian deficiency, which is either primary or secondary to a pituitary or other glandular malfunction.

STUDY OF 19 ADDITIONAL CASES OF PSEUDOMENSTRUATION IN STERILE WOMEN

Since the report (20) mentioned on the occurrence of pseudomenstruation, we have studied uterine scrapings, obtained premenstrually, from an additional group of 65 regularly menstruating women suffering from functional sterility. There was no evidence of the secretory phase in 19 of the 65 specimens studied. The specimens were obtained by means of a thorough curettage several days before the expected flow. We refrained from recourse to the cannula method of endometrial biopsy because the few pieces of tissue obtainable by this procedure may not be truly representative of the endometrium as a whole.

The 65 women (selected from a group of several hundred sterile patients) had had urinalysis, blood count, complete physical examination, serological study, post-coital semen examination (Huehner), and tubal insufflation tests (Rubin) with normal results. The male partners were examined by a competent urologist and were found potentially fertile in each instance. Five of the 65 women were secondarily sterile, each of them having borne one child 4 to 12 years prior to the time of this study. The 60 remaining women were suffering from primary sterility, having been married for 2 to 15 years (average 4.5 years)

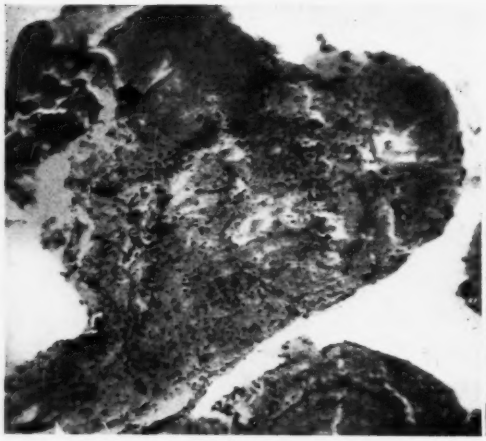
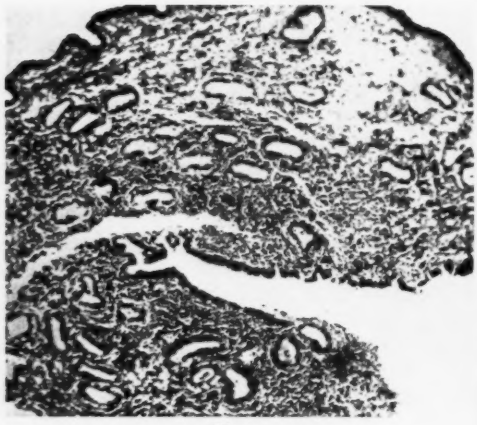


Fig. 5.

Fig. 6.



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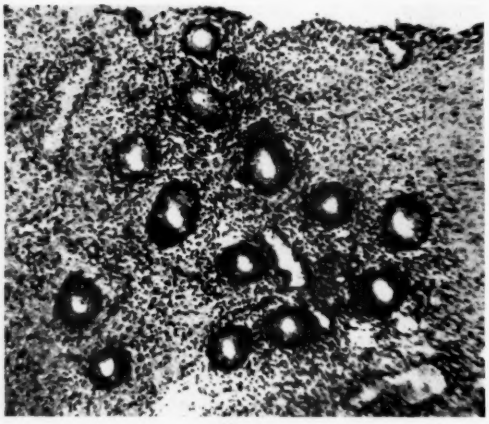

Fig. 8.

Fig. 5. Case 3. Endometrium of a physician, aged 34, obtained premenstrually by thorough curettage. Note the extreme atrophy despite regularity of menstruation since the age of 14 years. Another curettage performed several months later recovered a similar specimen. × 60.

Fig. 6. Case 14. Endometrium of a regularly menstruating, sterile woman, aged 32, obtained premenstrually. Note the total absence of the secretory phase and a moderate degree of endometrial hypoplasia. × 64.

Figs. 7 (× 10) and 8 (× 73). Cases 8 and 11. Photomicrographs of specimens of endometrium obtained from 2 regularly menstruating, sterile women at the very beginning of menstruation. Note that there is the total absence of the secretory phase.

without issue. The average age of the entire group of 65 women was 28.2 years. Their menstrual cycles ranged from 21 to 35 days and averaged 28.8 days. The duration of the menstrual periods varied from 3 to 7 days, and averaged 4.9 days. Five women of this group had previously been treated for irregular menstruation or amenorrhea by low dosage irradiation of the pituitary gland and ovaries which resulted in the establishment of regular menstrual cycles for more than a year prior to the date of premenstrual curettements. Seven of the group of 65 women (10.7 per cent) suffered from primary dysmenorrhea. The endometrial specimens were obtained from 1 to 6 days (average 3.8 days) prior to

Fig. 9.

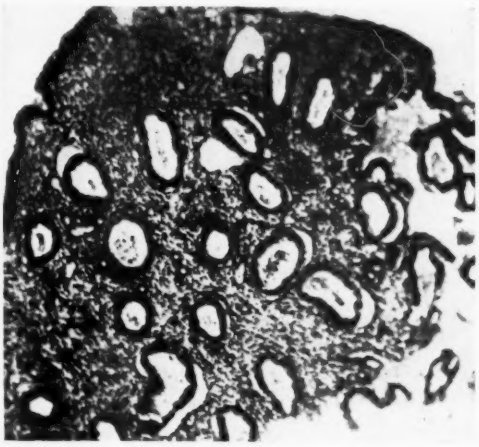

Fig. 10.

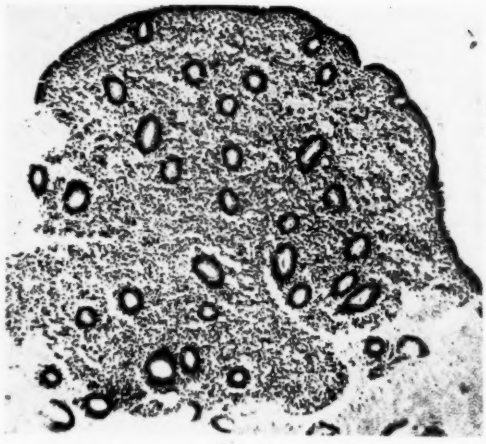

Fig. 11.

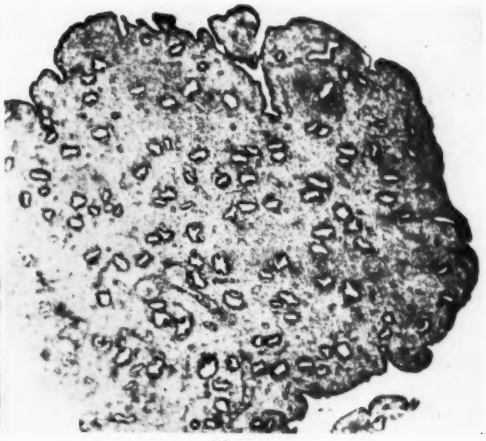

Fig. 12.

Figs. 9 (× 60), 10 (× 60), 11 (× 65), 12 (× 22). Photomicrographs of specimens of endometrium obtained from regularly menstruating, sterile women a few days before the expected flow. All of these women have subsequently menstruated on time. Note especially the total absence of the secretory phase.

the subsequent menstrual flow. Six additional patients falling into the category of pseudomenstruation in sterile women are not included in this report because the expected flow failed to appear following the curettage. For the sake of accuracy, it was assumed that they would not menstruate on time irrespective of the operative interference. The endometria of 46 of the 65 women (70.8 per cent) showed the secretory changes of the premenstrual period. However, in 8 of this group of 46, unmistakable areas of hyperplasia were present, indicating the presence of a disproportion between the two ovarian hormones (estrogenic substance dominance). The endometria of the 19 remaining patients of the group of 65 (29.2 per cent) showed no evidence of a secretory phase (pseudomenstruation), despite the fact that the expected menstruation occurred from 1 to 6 days following the

TABLE II.—DATA RELATIVE TO 19 REGULARLY-MENSTRUATING, STERILE WOMEN WITH PSEUDOMENSTRUATION

Case No.	Age	Menstrual history in relation to curettage				Histologic diagnosis of endometrium
		Type of cycle		Day of cycle when curetted	Day after curettage period appeared	
		Days of bleeding	Days of complete cycle			
1	30	5–6	28	25	3	Hypoplasia
2	26	4	28	26	2	Hypoplasia
3	34	5–7	28	22	6	Hypoplasia
4	33	3–4	31	25	3	Hypoplasia
5	31	2–3	30–31	27	5	Hyperplasia
6	28	3–4	28	22	6	Hyperplasia
7	27	2–4	28	25	2	Hyperplasia
8	23	7–8	28	24	2	Proliferative
9	32	3–4	21–25	23	2	Proliferative
10	32	3–5	28	23	5	Proliferative
11	27	3–5	26–28	23	3	Proliferative
12	29	5–6	30	25	2	Proliferative
13	32	3–4	26–27	23	2	Proliferative
14	32	3–4	28	23	4	Proliferative
15	31	4–5	28	24	4	Proliferative
16	30	4–7	21–25	23	2	Proliferative
17	23	7–10	21–25	23	1	Proliferative
18	32	5–6	28–30	23	3	Proliferative
19	30	5	28–30	27	2	Proliferative

curettage in each instance (Table II). Of the 19 abnormal endometria, 12 were of the interval (proliferative) type, 4 hypoplastic, and 3 hyperplastic (Figs. 5 to 12).

CONCLUSIONS

1. Cyclic uterine bleeding, clinically indistinguishable from normal menstruation, from an endometrium totally lacking the usual secretory changes, occurs in 30 per cent of sterile women who present no abnormality.

2. The condition is rarely encountered in fertile or potentially fertile women.

3. The condition may be due to failure of ovulation, a developmental or acquired lack of responsiveness of the uterus to a normal ovarian activity or to a quantitative or qualitative disharmony between the two ovarian hormones, estrin and progestin.

4. When the diagnosis is based on endometrial findings alone, the term "pseudomenstruation" is preferable to "anovular menstruation" because the presence of the latter cannot be proved without concomitant study of the ovaries.

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CHORDOMA

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THE suggestion that notochordal remains might form the starting point of a characteristic type of tumor was originally made by Mueller in 1858. Up till then, interest in the structure and fate of the primitive skeletal axis had been academic and anatomical, but with this new observation the notochord acquired a practical significance. The tumor—named "chordoma" by Ribbert—is one of considerable interest; its structure is distinctive, and it has a curious tendency to appear toward the extremities of the vertebral column. Reports of chordoma have become increasingly common during the last few years, yet in any individual experience they are sufficiently rare to warrant the following account of two cases which we have had an opportunity of studying.

CASE 1. Mrs. G., aged 44 years, was admitted to the Royal Infirmary complaining of weakness and loss of power in the legs. There was a history of a previous blow over the lumbar part of the spine, but this had occasioned her but trifling inconvenience and had apparently been completely recovered from.

A year before admission, she had had a severe attack of "cramp" in the left leg, lasting 10 minutes; a fortnight later she suffered a further attack of pain in the coccygeal region, and this was followed by the development of a large bluish-black patch on her left thigh. Shortly afterward, shooting pains began in both legs, and 8 months prior to admission the limbs became stiff and she began to lose weight. Two months later, she noticed that her legs were becoming numb, and the numbness gradually spread until it affected both lower limbs below the knee.

On examination, there was found a large swelling in the region of the lower lumbar vertebræ; the tumor was stony hard in consistence, but not adherent to the skin. Large dilated vessels were apparent in the subcutaneous tissues. The lower limbs were the site of an almost complete flaccid paralysis.

Radiological investigation revealed a fairly regular area of destruction on either side of the fourth lumbar vertebra, the articular and spinous processes having almost completely disappeared. The appearances were held to indicate neoplasm (Fig. 1).

At biopsy a portion of an exceedingly vascular tumor was removed for microscopical investigation.

From the Department of Clinical Surgery, Edinburgh University.

Histological appearances. The tumor was composed of sheets of cells separated into lobules by strands of connective tissue; necrosis was present at the central part of the lobules and considerable hemorrhage had occurred in certain areas (Fig. 2).

The cells were characterized by vacuolation of their cytoplasm (Fig. 3); the vacuolation was due to the accumulation of intracellular mucin, and the appearance was exactly similar to that of the physaliphorous cells originally described in connection with notochordal remains by Virchow. In some areas, progressive intracellular accumulation had led to rupture of the cell envelope, so that the appearance was one of a syncytium-like mass of mucinoid material containing scattered nuclei (Fig. 4). As a general rule, the more perfectly preserved cells were to be observed toward the periphery of the lobule, and it was in this situation that mitotic activity was maximal.

The nuclei varied greatly in size, shape, and staining reaction. The majority were ovoid, but round and polymorphous forms were also present. Nuclear degeneration was common in the syncytium-like mass and in the necrotic areas, and in some fields, intranuclear vacuolation was observed, though extreme examples of this phenomenon, as described by Stewart, were not present (Fig. 5).

The stroma was composed of a series of fibrous tissue septa in which the vessels of the tumor were running. Those cells of the lobules which lined the septa were compressed, and in places had invaded the fibrous strands.

CASE 2. Mrs. McD. was 62 years of age when she was admitted to the Royal Infirmary. Seventeen months before, she began to experience a gnawing pain in the region of the sacrum, followed, after an interval of 6 months, by the appearance of a swelling, about the size of a walnut, in the same situation. These features appeared spontaneously; there was no history of preceding trauma.

At that time, the patient sought medical advice; the swelling was found to be soft in consistence and was incised, apparently in the belief that it was an abscess; but after incision it increased rapidly in size, and at the site of incision, a large ulcer developed. A diagnosis of sarcoma of the sacrum was accordingly made and was apparently supported by the fact that she began to suffer from weakness in the right leg, shooting pains in the right foot, and frequency of micturition—the evidence at least of a progressive lesion.

After a course of deep x-ray therapy, she improved for a time; thereafter, the tumor became much larger, and she was admitted to the Edinburgh Royal Infirmary.

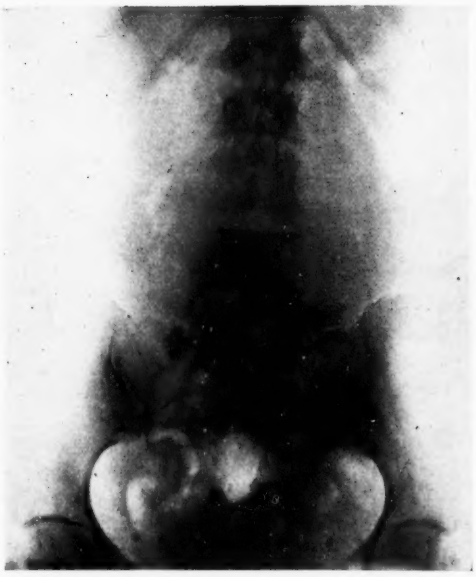

Fig. 1. Anteroposterior roentgenograph of Case 1. Note the destruction apparent at each side of the body of the fourth lumbar vertebra. The transverse processes have disappeared.

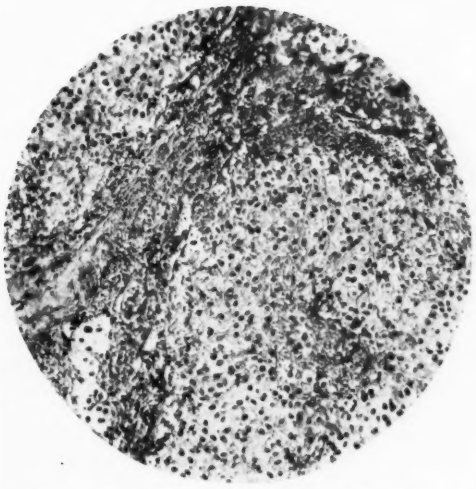

Fig. 2. Photomicrograph of tumor. The tumor is broken up into lobules by strands of fibrous tissue. The cells of the lobules show marked vacuolation. ×80.

When submitted to examination there, a large tumor was found to be present in relation to the lower part of the spine; the main bulk of the tumor projecting backward and downward from the sacrum. Above, it extended to the mid-lumbar region, below it reached as far as the gluteal fold on the left side and to a point just above that level on the right (Fig. 6). Laterally, its margin was situated immediately behind the greater trochanter. The surface of the tumor showed obvious areas of bossing, and the superficial veins were enormously distended. Three small sinuses were obvious at the site of the previous incision (Fig. 7).

The tumor on palpation appeared for the most part firm and hard in consistence, but here and there were areas of softening, almost suggesting fluctuation.

Abdominal examination conveyed a sense of fullness and increased resistance at the pelvic brim, while the digital investigation of the rectum revealed a tumor bulging forward through the posterior rectal wall; the growth again had suggestive

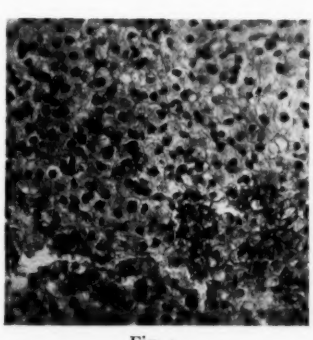

Fig. 3.

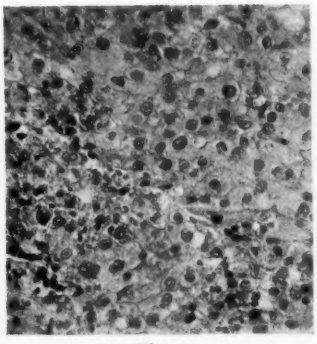

Fig. 4.

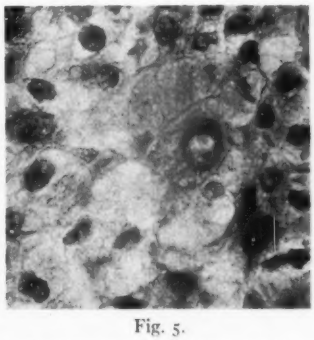

Fig. 5.

Fig. 3. High power photomicrograph showing the vacuolation of the cells. ×140.

Fig. 4. High power photomicrograph to show syncytial mass of mucinoid material with many scattered nuclei. ×130.

Fig. 5. Photomicrograph to show vacuolation of nuclei. ×550.

Fig. 6. Lateral photograph showing the extent of the tumor in Case 2.

Fig. 7. The surface of the tumor in Case 2. The sinuses at the site of the previous incision are well seen.

areas of softening, although the main consistence was firm almost to hardness.

Radiological examination (Fig. 8) was carried out with great difficulty and owing to the adiposity of the patient, the roentgenograms were far from perfect. They showed, however, that the sacrum and coccyx were almost completely replaced by a large and ill-defined tumor, which appeared to be more dense in the position of the bony column. On the right side, the sacro-iliac joint was almost completely destroyed. On the left side also it had been invaded, but to less extent, by the tumor.

A fruitless attempt was made to remove the tumor. When the skin and subcutaneous tissues had been incised, the underlying muscles were seen to be stretched out over the growth, which was partially surrounded by a fibrous capsule. The surface was lobulated, save where the neoplastic process had extended into the muscle. Owing to its infiltrating character and to pronounced vascularity, radical extirpation was considered impossible, and the attempt was abandoned. A small portion, however, was removed for histological study.

Histological examination. The microscopic appearances were essentially similar to those of the first case, but the tumor was less cellular, and the individuality of the cell more uniformly preserved. Lobulation by fibrous septa was less marked (Fig. 9).

The recognition of notochordal tumors is a matter of the last 30 or 40 years, and is due mainly to the observations of Ribbert. Luschka in 1856 had reported a curious jelly-like intracranial growth protruding from the clivus, but could not account for its presence. Virchow, a year later, described a similar tumor in a comparable situation, which his histological observations led him to believe was of cartilaginous origin. He regarded the cartilage cells as degenerate, and accordingly referred to these growths as physaliphorous ecchondroses.

In the following year, Mueller suggested that similar tumors might grow from notochordal remains. He made a close study of the development and histology of the notochord and was able to show that in the fetus, it extended cranially as far as the sella turcica. He also showed that "rests" of notochordal tissue could occur in the basilar cartilage, while in the spheno-occipital synchondrosis, it frequently persisted as a small mass of soft jelly-like tissue resembling the nucleus pulposus of an invertebral disc.

It was left to Ribbert to produce incontrovertible proof and to suggest the name chordoma. Ribbert's evidence is of three kinds—anatomical, histological, and experimental. He emphasized that, as regards the skull, the tumor is constantly situated in the midline where notochordal tumors would inevitably occur. From a histological study of the tumors, he concluded that the resemblance of the tumor cells to degenerate cartilage was more apparent than real, and he was unable to find any areas of normal cartilage.

His experimental evidence is very important. He punctured the intervertebral disc of a rabbit, so that the notochordal tissue of the nucleus pulposus was extravasated outside the vertebral column. Subsequently the herniated tissue proliferated and presented the histological features of the physaliphorous ecchondroses.

Fig. 8. Roentgenograph of Case 2. The sacrum is completely destroyed, and the indefinite outline of the tumor can be vaguely determined.

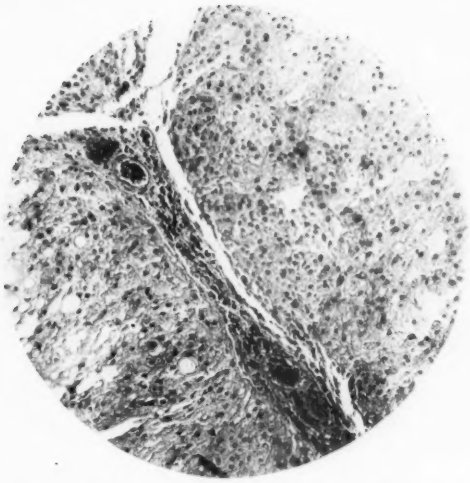

Fig. 9. The histological appearances in Case 2. The tumor is essentially similar, but less cellular. Cell vacuolation is again prominent. ×100.

It is now fairly clear that the physaliphorous ecchondrosis of Virchow—or, to give it the more accurate title of Stewart—ecchordosis physaliphora spheno-occipitalis, is not a true tumor. It is not infrequently encountered by chance during autopsy for some unrelated condition, and it appears more likely that it is a true persistence of notochordal tissue which may, however, undergo neoplastic transformation into chordoma.

Since 1894, a considerable series of notochordal tumors have been added to the literature, and the condition is now a well defined clinical and pathological entity.

The localization of the tumor. One of the most curious features of chordoma is the site localization. The original descriptions were of intracranial growths in the region of the spheno-occipital synchondrosis, and Hennig was the first authority to report on extracranial chordoma—in the sacro-coccygeal region of a young infant. The occurrence of the tumor in sites other than the extremities of the spinal column was not appreciated until Syme and Capell (11) in 1925 reported a chordoma of the cervical spine. Capell (1) has since reported the development of the tumor in the dorsal spine.

We have traced in the literature the records of 103 cases, of which the distribution is as follows:

	Cases
Cranial	
Spheno-occipital	33
Occipital	1
Jaws	2
Sacrococcygeal region	56
Intermediate part of spine	
Cervical	6
Thoracic	1
Lumbar	4

The spheno-occipital group includes growths which project intracranially from the synchondrosis; and those (11 of 33 cases, i.e. 33 per cent) which project into roof of pharynx.

To explain the site localization of chordoma, it is necessary to review briefly the development of the notochord.

The development of the notochord. In the second week of intra-uterine life, a linear furrow is formed in the central axis of the embryonic area by a thickening of the embryonic ectoderm. This is the primitive groove, and from its anterior end, the growth in length of the embryo takes place. At the anterior end of the groove, an opening is situated which represents the dorsal extremity of the neurenteric canal.

In the third week, the ectoderm has extended forward from the primitive groove for a considerable distance, and a central furrow is apparent. the lateral walls of which even-

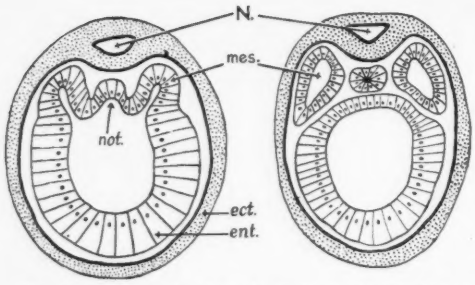

Fig. 10. Diagram to show the method of formation of the notochord by evagination from the dorsal aspect of the archenteron. (After Frazer.)

tually expand, grow toward each other and fuse, to form the *neural tube.*

Immediately below the dorsal ectoderm is the archenteric cavity with its enclosing layer of entoderm. In the midline of the body ectoderm and entoderm are in direct apposition, but laterally, the two layers are separated by the paraxial mesoblast.

By about the middle of the third week, a strip of cells along the median dorsal wall of the entodermal archenteron are evaginated (Fig. 10) to form a tube—the *notochordal canal*—which later loses its lumen and becomes finally detached from the entoderm to form the notochord, a solid rod of cells interposed between the developing neural groove and the archenteron.

The fate of the notochord. The paraxial mesoderm later comes to surround the notochord and to form a sheath for it, as also for the neural tube; the sheath is the anlagen of the vertebral column.

The major part of the notochord begins to disappear in the second month of fetal life, and from the point of view of the present communication, interest mainly centers round the situations in which it may or does persist.

The membranous sheath becomes chondrified and later ossified, forming at the anterior extremity the basi-occiput and the basisphenoid, and elsewhere the vertebral column. The progress of ossification in the individual vertebra leads by pressure to the disappearance of the notochordal tissue in the center of the vertebral body, but in the intervertebral space, a spheroid of tissue persists as the nucleus pulposus.

At the anterior end, the notochord traverses the middle of the body of the dens and passes up to the cartilaginous base of the skull in the suspensory ligament of the dens. At first it is included between the developing halves of the skull base, but further forward, it passes on to the pharyngeal surface of the base, and finally turns upward to terminate in the skull base posterior to the dorsum sellæ (Fig. 11).

Such are the usual cranial relationships of the notochord; there is no doubt, however, that in the region of the spheno-occipital synchondrosis, the notochord may make a further loop upward and come to lie on the actual cranial aspect of the base (Fig. 11). It may be said, therefore, that normally in one, and possibly in two situations in relation to the skull base, the notochord may escape being confined within, or compressed by, cartilage or bone:

1. At the site of the intrapharyngeal loop.
2. In the region of the spheno-occipital synchondrosis where it often makes an intracranial loop.

In the sacrococcygeal region a destructive fate also befalls the posterior end of the notochord. Along with its membranous sheath, it extends for a considerable distance beyond the extent of the adult vertebral column—and even beyond the termination of the membranous sheath, it is continued into the tail end of the embryo (Fig. 12). With the curtailment of the coccygeal end of the vertebral column and the disappearance of the tail bud, a considerable part of the caudal end of the notochord must disappear.

The relation of development of tumor growth. It is significant that notochordal tissue normally persists in the intervertebral discs; that abnormal persistences have been reported on the cranial aspect of the spheno-occipital synchondrosis; and that the majority of chordomas arises in the basicranial and sacrococcygeal regions. The factor common to these situations of normal, abnormal, and pathological occurrences of notochordal tissue is the absence of bony compression. It seems that once encased in bone, the notochordal tissue does not usually survive, but in the absence of a bony envelope it may, and often does, persist. In the situations where ab-

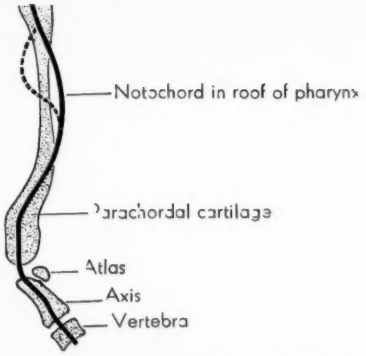

Fig. 11. Diagram to show the course of the notochord at the base of the skull. The usual course is indicated by the continuous line. The interrupted line represents the occasional incursion on to intracranial aspect of the base. (After Keith.)

normal persistences have been shown to be likely, there is the further feature that the notochordal tissue is not even restrained by a sheath of fibrous tissue as in the case of the nucleus pulposus of the discs. That these facts may have some relation to subsequent tumor development is likely. Thus Newlands ascribes chordoma to persistence of notochordal tissue when it escapes inclusion by bone, while Ribbert's (8) classical experiments suggest that in these situations it may be the absence of proper fibrous tissue encapsulation that is the significant circumstance.

The relation of trauma to the chordoma. In the first of our cases, the lumbar segment of the spine was affected, and there was a definite history of injury preceding the development of the tumor. It is difficult to dissociate the two as cause and effect, and there is additional evidence that the relationship may be a direct one. The occurrence of such tumors in the intermediate part of the spine at once suggests an origin from the nucleus pulposus of the intervertebral disc, and Ribbert's experimental production of chordoma following the release of the nuclear tissue from its fibrous sheath by puncture suggests that the traumatic influence may be important.

The recent researches of Schmorl and his Dresden co-workers seems to strengthen this view, for the escape of notochordal tissue from the disc into the spongy tissue of the

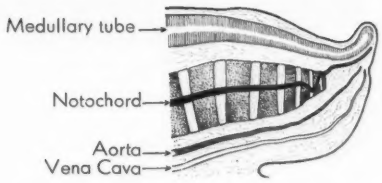

Fig. 12. Schematic representation of the caudal relations of the notochord, which is here continued beyond the termination of the vertebral column.

vertebral body and anterior and posterior aspects of the body is an occasional feature of spinal injuries. Schmorl indeed remarks on the occurrence of nodules of notochordal tissue on the posterior aspect of the lumbar bodies, but suggests that in some cases they may have a congenital origin. Dandy, too, has operated on 2 cases in which spinal cord compression has resulted from tumors growing from the back of the vertebral bodies, and apparently cartilaginous in nature. In the light of recent work, they are certainly of notochordal origin and their structure is in all respects similar to the physaliphorous ecchordosis of the sphenoccipital region.

It would appear, therefore, that chordomas may arise in two ways:

1. From the persistence of notochordal tissue in abnormal situations.

2. From the traumatic release of notochordal tissue from situations in which it is normally found but imprisoned in a fibrous envelope.

The pathology of chordoma. The account of the pathological features of chordoma given by Stewart is so complete that addition to it is impossible.

The tumor is usually encapsulated, rounded, and lobulated by a series of thick fibrous septa. Its cut surface is glistening, and in many of the lobules there is mucoid degeneration so that the consistence of the tumor is semi-solid. Hemorrhages of varying size and age are present in those degenerate areas, but when the mucoid change is less advanced the tumor may appear granular and opaque.

The histological features. All the recorded cases reviewed by Stewart were broken up into lobules by a stroma composed of fibrous septa. The connective tissue of the stroma is prone

to hyaline degeneration and may be infiltrated with lymphocytes, polymorphonuclears or eosinophile cells. Frank hemorrhage is not infrequently observed and evidence of former hemorrhages sometimes exists in the form of pigment-distended reticulo-endothelial cells. The parenchyma of the tumor presents a very variable appearance. Active cellular tissue may be present, the cells polygonal in outline and with fairly well defined borders. These cells are more usually present toward the periphery of the lobule, but occasionally comprise a whole lobule.

The mechanism of mucoid regeneration is invariably apparent. As the cell is traced from the periphery of the lobule toward the center, droplets of mucin collect within the cytoplasm, giving rise to the appearance of vacuolation. The accumulation of mucin proceeds until the cell is distended and the nucleus displaced, until ultimately the cell envelope, unable to contain the increasing mass of mucin, ruptures. The mucin now escapes and lies free between and around the shrunken cells in the central area of the lobule.

The nuclei of the cells may vary greatly in appearance, but are for the most part oval or spherical. In the areas of greatest mucoid change, however, they may be shriveled and crenated. In the more cellular areas they may contain one or more vacuoles of mucin and occasionally may become so distended that they are ballooned out, forming the typical "physaliphorous nuclei" first described by Stewart. Hyperchromatism and active mitotic activity are only present in certain cases of malignancy.

Relation of the histology to the cytomorphosis of the notochord. It is now apparent that, in their histology, notochordal tumors reflect the cytomorphosis of the original notochord. Capell, Newlands and Woolard have drawn attention to the fact that the notochord at first consists of a rod of polygonal epithelium-like cells arranged in front of the developing nervous system along the whole length of the embryo. These cells originally have no peripheral delimitation from the surrounding structures, but they soon acquire a sheath which has developed from the adjacent mesoderm.

The cells next undergo mucinoid degeneration; toward the periphery of the rod, the mucin is discharged from the cell and comes to surround the column as a secondary or internal sheath. In the center of the column, the mucin is contained within the cell envelope, and to the consequent turgescence of its cells, the notochord owes its supporting properties.

In the last stage—seen in the intervertebral disc—when the notochord is enclosed in fibrous tissue, the cell envelope may be destroyed and the nucleus left embedded in a syncytium-like mass of mucinoid material.

There are thus three stages in the cytomorphosis: (1) the stage of non-vacuolated polygonal cells; (2) the stage of vacuolated mucin-containing cells; (3) the syncytial stage of intercellular mucoid accumulation.

These stages are reproduced with faithful exactitude in chordoma, and from the preponderance of any one of the above appearances in individual tumors, some information as to its relative malignancy may be gained. Thus, the cellular tumors, with little or no vacuolation, represent the most malignant type; the syncytial arrangement of the tumor cells the most benignant form of neoplasm.

CLINICAL ASPECTS OF THE CHORDOMA

The cranial chordoma. The intracranial type. The intracranial type of tumor begins near the spheno-occipital synchondrosis and tends to extend at the expense of the surrounding bone, and of the brain. Thus it may erode the dorsum sellæ and invade the pituitary; while it also spreads ultimately to involve the brain stem.

The nasopharyngeal tumor is situated in the roof of the pharynx, but it may spread to involve the nose and jaws, or the maxillary antra: in at least one reported case, the tumor —in a newborn infant—actually projected from the mouth.

The sacrococcygeal chordoma. In many of the published cases of sacrococcygeal neoplasm, injury appears to have been a precipitating factor, but in our case, no such trauma appears to have occurred.

Usually, as in the present case, the first evidence of trouble is severe pain in the region

of the sacrum, followed, after an interval, by the appearance of the tumor. The tumor may show its most exuberant growth either anteriorly or posteriorly; if it tends to spread to the front, interference with micturition and defecation are early evidences of its presence.

In virtue of its position, the tumor may early implicate the pelvic nerves; indeed, it may be that the visceral disturbances mentioned are the result of disordered nerve impulses rather than of mechanical pressure, though it is likely both factors are at work.

The tumor is at first situated above the midline, but, as it enlarges, its situation becomes more asymmetrical. The surface frequently shows bossing; and the veins of the subcutaneous tissues become prominently dilated.

In the present case, there was, in addition to the features stated, marked weakness of the leg, and pain in the distribution of the sciatic nerve. The latter, as well as the other gluteal nerves, may be surrounded and infiltrated in large tumors which grow down into the region of the buttocks.

The spinal chordoma. No region of the spine is immune, but chordoma is relatively rare in the lumbar region. A history of antecedent trauma is common.

The tumor usually commences on the posterior aspect of the vertebral bodies; and it follows that the earliest signs of its presence are due to its compressive effects on the spinal cord. In the higher segments of the spine the sequelæ are spastic paraplegia below the lesion with increasing sensory disturbance until numbness and anesthesia result.

In the lumbar region, however, the neoplasm in its advance implicates the cauda equina, and there is a flaccid paralysis of irregular distribution in the lower limbs, as in the first case reported here.

The lumbar chordomas are more often preceded by a history of recurrent attacks of pain than the others, since the sensory nerves are more rapidly encompassed.

PROGNOSIS IN CHORDOMA

The prognosis in chordoma varies with the position, the duration, and the histological type of the tumor. In some cases—as in small intracranial and intrapharyngeal tumors, and in small intraspinal tumors—removal has been successfully accomplished. Young has also been able to extirpate completely a large sacrococcygeal tumor. In the sacrococcygeal chordoma reported here, however, the extension of the tumor beyond its capsule, and its vascularity made removal impossible.

In the event of removal of the tumor proving impossible, even a simple chordoma is ultimately fatal from encroachment on vital structures. This eventuality may be delayed for many years—as in Young's case—however; in the more malignant types of tumor, histologically very cellular, death may result very soon after the tumor becomes apparent.

TREATMENT OF CHORDOMA

It is evident that no universal technique for the management of chordoma can be indicated. Removal should be attempted in all save late cases, as even partial resection has been followed by improvement in symptoms.

When the situation of the growth or other circumstances render operation hazardous or impossible, recourse may be had to radium or deep x-ray therapy, though these have so far proved of very limited value.

Our thanks are due to Professor Sir John Fraser for his permission to investigate and report these cases, which were under his charge in the Royal Infirmary, Edinburgh. Mr. D. B. Smith has been responsible for the photomicrographs and our grateful thanks are due also to him.

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DERMOID CYSTS OF THE HEAD AND NECK

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WHILE dermoid cysts of the head and neck are of relatively infrequent occurrence, they should nevertheless be of interest to both those who specialize in surgery of the head and neck and to general surgeons as well. From 1910 to 1935, inclusive, 1,495 patients with dermoid cysts have been examined at The Mayo Clinic.

The distribution of the 1,495 cysts, which involved the entire body, may be noted in Figure 1. The greatest number of cysts (44.4 per cent), which included pilonidal cysts, occurred in the postanal region; 42.1 per cent of the cysts were found in the ovaries. Excluding patients who had cysts involving the brain and meninges, 103, or 6.9 per cent, of the patients had cysts that occurred in the regions about the head and neck.

SITUATION

We have divided dermoid cysts of the head and neck into four groups, in accordance not only with their anatomic situation, but also with the embryonic structure from which each group is derived: (1) cysts about the eyes and orbits, originating along the naso-optic groove; (2) those about the nose, resulting from intrusion of the frontonasal plate between the embryonic nasal dermis and mucosa; (3) those about the floor of the mouth and in the submental and submaxillary regions, originating from the upper branchial arches; and (4) a miscellaneous group, most of which occur in the midline and develop during closure at the midventral and middorsal lines of the body (Fig. 2).

Of the 103 dermoid cysts about the head and neck, 49.5 per cent came under the classification of group I, 12.6 per cent of group II, 23.3 per cent of group III, and 14.6 per cent of group IV (Fig. 3).

From the Section on Laryngology, Oral and Plastic Surgery, The Mayo Clinic. Read before the meeting of the Section on Otolaryngology of the College of Physicians of Philadelphia, Philadelphia, Pennsylvania, October 21, 1936.

EMBRYOLOGY AND PATHOLOGY

Dermoid cysts in general have been classified on the basis of their pathogenesis as well as their gross and microscopic appearance into the following three types:

1. Congenital dermoid cysts of teratoma type: These are complex in structure and arise from embryonic germinal epithelium. According to the blastomere theory, such a tumor is thought to originate in a developing blastomere, some cells of which become separated or displaced; the remaining cells of the blastomere develop into normal cells, whereas the misplaced cells lie dormant. Later, however, perhaps through some chemical process, these dormant cells become activated and evolve a dermoid or a teratoma. Dermoid cysts of this type have a thick wall which contains elements derived from any one, or from all three, of the germinal layers: epithelium, bone, and cartilage. These cysts also contain well developed structures, such as skin, hair, nails, and teeth. Brain and glandular tissues frequently are present. Usually cysts of this type are confined to the ovaries and testes, although occasionally they are found elsewhere, as in the sacral region.

2. Acquired implantation dermoid cysts: These are merely inclusion cysts that develop as a result of trauma. A portion of the skin is carried into the deeper structures of the wound where the dermal cells form a cyst lined with squamous epithelium. They occur particularly on the hands and other exposed parts of the body.

3. Congenital inclusion dermoid cysts: These develop along the lines of embryonic fusion, such as the midventral and middorsal lines and the branchial clefts. They are cysts that develop from inclusions of displaced dermal cells along such lines of fusion. Histologically they are very simple in structure. Their walls usually are thick and fibrous and are lined with squamous epithelium that resembles skin and contains hair follicles and

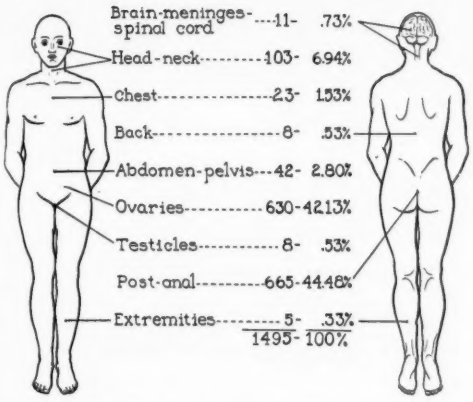

Fig. 1. Distribution of 1,495 dermoid cysts encountered at the clinic.

sweat and sebaceous glands. The cavities of these cysts are filled with a greasy, caseous material which is often mixed with hair. Such structures as cartilage, bone, and lymphoid tissue are said to be found occasionally. Many of these cysts have a sinus from which sebaceous material can be expressed and from which, in some instances, hairs can be seen protruding.

Almost all of the 103 dermoid cysts in this series which involved the head and neck contained sebaceous material, but in only 30 per cent of them were tangles of hair to be found. Microscopically, their walls were typical of congenital inclusion dermoid cysts. With the exception of one cyst in the upper outer quadrant of the right orbit in which a little cartilage was discovered, no cartilage, bone, or lymphoid tissue was found in any of them. None contained such organized structures as teeth, nails, or glandular tissues. Many were infected, their capsules being somewhat adherent to the surrounding tissues and their cavities containing much pus intermixed with the sebaceous material.

It is interesting to observe that in one case in which a dermoid involved the soft palate a squamous cell epithelioma, grade II, developed. The patient was a woman 53 years of age. She had noticed the growth for about 18 months. A year prior to her registration at the clinic it had been excised, but it had promptly re-

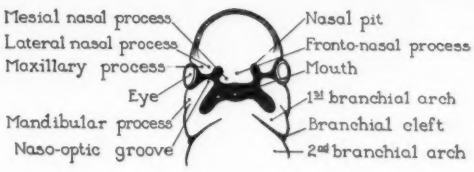

Fig. 2. Origin of cysts of head and neck.

curred and had grown rather rapidly. Examination revealed a rounded, non-ulcerated, and well localized mass. On excision, the dermoid and the malignant lesion were discovered, and consequently the bed of the tumor was thoroughly cauterized. The patient made a complete recovery.

Cysts of group I which occur in and around the orbital region develop, as has been said, along the naso-optic groove which lies between the maxillary and mandibular processes. During fusion of these processes, small groups of cells dip down into the deeper tissues and become segregated from the surface epithelium. In time these epithelial rests develop into dermoid tumors. It is not surprising that a greater percentage of these cysts occur in the orbital region than elsewhere about the head and neck when one considers the complexity of the embryonic development of the eyes and lids, which are situated at the outer angle of the naso-optic groove.

The pathogenesis of dermoids of group II, which occur over the nasal bridge, is difficult to explain. Luongo interpreted their formation as follows: "In the early embryo, the frontonasal plate, which forms the nose, consists of a lamina of hyaline cartilage covered

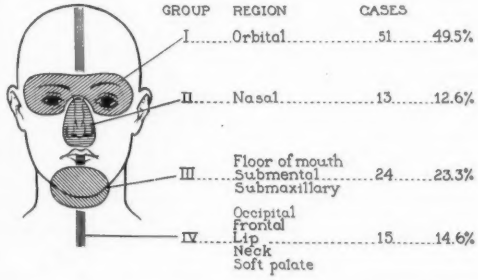

Fig. 3. Classification of cysts of head and neck according to groups.

Fig. 4. Pre-auricular sinus, branchial cleft in father and son.

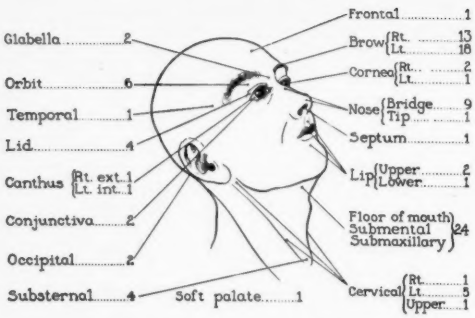

Fig. 5. Situation of cysts of head and neck.

externally with skin and internally with mucosa. After the third month of embryonal life, bony tissue extends in between the cartilage and skin. The bony tissue will form the nasal bones. The cartilage becomes absorbed during the process of ossification. During the gradual separation of the skin from the cartilage of the frontonasal plate by the intrusion of the nasal bones, small portions of the skin or epithelium become sequestrated and develop into dermoid cysts." Dermoid cysts that occur in the base of the columella and in the adjacent upper lip may develop during fusion of the two mesial nasal processes.

Dermoid cysts of group III, which arise in the floor of the mouth and in the submental region, are derived from ectoderm sequestrated during union of each first and second branchial arch with its fellow of the opposite side. There is also a group of cysts in the zygomatic and parotid regions (Fig. 4) which clinically resemble dermoid or branchial cysts. From the embryologic point of view, of course, these should be dermoid cysts arising from the branchial arches; however, they have been classified as branchial cysts because of their microscopic appearance.

Cysts of group IV, those in the suprasternal fossa and in the occipital region, are formed during closure of the midventral and middorsal lines. Fusion of the branchial arches is doubtless responsible for some dermoids in the laryngeal and upper cervical regions. Such a cyst in the lower lip results from union of the mandibular processes, whereas a cyst located in the soft palate results from the fusion of the palatine plates which grow from the maxillary processes to the midline to form the palate.

Dermoid cysts in the frontal region and other parts of the cranium arise during fusion of the cranial bones. As has been explained by several authors, the developing cranial bones lie between the embryonic skin and dura. As the bones grow toward each other to form the suture lines, groups of dermal cells become cut off from the surface epithelium, and this results in the formation of dermoid cysts.

From pathological study of these 103 dermoid cysts, it appears that practically all dermoids about the head and neck are very simple cysts of the congenital inclusion type. Although they may arise from several different embryonic structures, fundamentally all have a similar origin.

AGE OF PATIENTS AND SIZE OF CYSTS

Of the 103 patients, 53 (51 per cent) were males and 50 (49 per cent) were females. The ages of the patients at the time of operation varied from 14 months to 72 years, about 60 per cent being between the ages of 15 and 35 years. This, however, does not correspond in any degree to the ages of the patients at the time when the dermoid first became notice-

TABLE I.—AGE AT WHICH DERMOID CYSTS OF THE HEAD AND NECK WERE FIRST NOTICED

Age	Cases	Per cent
At birth	32	37.2
From birth to 1 year	9	10.4
2 to 5 years	13	15.1
6 to 10 years	4	4.6
11 to 15 years	8	9.3
16 to 20 years	6	6.9
21 to 30 years	9	10.4
31 to 40 years	1	1.1
41 to 50 years	2	2.3
51 to 59 years	2	2.3
Total	86	
Age when first noticed unknown	17	

able. As may be noted in Table I, 37.2 per cent of the tumors were present at birth, whereas 62.7 per cent were observed by the fifth year. One patient did not notice the cyst until he was 59 years old.

The cysts ranged from 4 millimeters to 10 centimeters in diameter, the larger ones being located in the floor of the mouth and in the submental region. In 26 per cent of the cases there was a history of previous attempts at removal or of incisions for drainage.

DERMOID CYSTS OF THE ORBITAL REGION

Fifty-one cases in which dermoid cysts occurred in the orbital regions have been encountered at the clinic. The most common site for these tumors is on the outer third of the brow; in fact, more dermoids are encountered in this region than in any other part of the head and neck, 31, or 60 per cent, of the 51 cysts being in this situation (Fig. 5).

The left brow was involved more frequently than the right. These 31 dermoids varied from 1 to 6 centimeters in diameter, the majority measuring 2 or 2.5 centimeters. Larger cysts extended laterally into the temporal regions or down into the upper eyelids. All but one were evident by the fifth year, and 52 per cent were present at birth. Several of them were not noticed until they were injured accidentally. In a few cases trauma caused the affected tumors to undergo a sudden increase in rate of growth. Except for slight tenderness or a discharging sinus, which occurred in 2 cases, these dermoids were practically symptomless. The patients came for

Fig. 6. Dermoid cyst of right brow.

operation merely for removal of a disfiguring "lump" on the brow (Fig. 6). On palpation, a few of the cysts, especially smaller ones, were firm; the majority, however, were soft and cystic. In some cases a sense of fluctuation could be elicited, and in the case of large tumors a doughy feeling, so characteristic of dermoid cyst, was present. Some were fixed to underlying bone whereas others were freely movable.

On excision, several of these tumors were found to have produced crater-like depressions in the underlying bone. In an occasional case, cord-like extensions into the surrounding soft and bony tissues were discovered. Dermoids are but rarely seen at the inner angles of the brows. In our experience we have seen only 3 such cases.

Six of these 51 orbital dermoids were located within the orbit (Fig. 5), 5 of them being in the upper outer quadrant of the right orbit. When large, such tumors have a tendency to produce exophthalmos.

While we have not seen a dermoid involving the lower lid, 4 dermoids involving the upper eyelids and 2 of the canthi were encountered (Fig. 5). Two of these dermoids were of sufficient size to cause blurring of vision. From

Fig. 7. Dermoid cyst of the nose affecting both mother and daughter.

one dermoid, situated on the cornea, three hairs protruded and caused considerable irritation of the conjunctiva.

The treatment of orbital dermoid cysts is excision. When adherent to bone, the periosteal attachment must be removed along with the tumor. Cord-like extensions should be removed, when present, if a cure is to be effected.

DERMOID CYSTS OF THE NOSE

Of the 13 dermoid cysts that involved the nose, 9 involved the bridge, 1 the tip, 2 the base of the columella, and 1 the septum (Fig. 7). All of those on the bridge were first noticed in infancy, 6 of them at birth. They varied from 4 millimeters to 2.5 centimeters in diameter, averaging about 1 centimeter. The histories obtained in these cases revealed that these dermoids usually began as a small nodule or papule, white, reddish, or dark blue. Later, there often became visible the opening of a sinus, which might or might not have discharged sebaceous material. Cysts in this region, aside from slight and gradual growth, cause no discomfort. The majority, however, become infected and periodically produce

Fig. 8. Dermoid cyst of the upper lip, showing the sinus in the midline at the base of the columella.

swelling, redness, and pain as well as a purulent discharge.

The 2 dermoids involving the base of the columella and upper lip also were apparent in early infancy, 1 at birth. In both cases a sinus from which sebaceous material discharged was present. In 1 of these cases the tumor gave the patient no trouble until he was 45 years of age (Fig. 8).

A dermoid of the septum in the case of a boy was of special interest because the tumor was associated with a congenital median cleft of the tip of the nose, columella, and upper lip. There was a marked tendency toward reduplication of the nose. When the patient was 7 weeks old primary closure of the cleft was effected by his family physician. Thirteen years later the boy registered at the clinic to undergo further surgical treatment to improve the cosmetic appearance of his nose. During a plastic procedure to correct the residual deformity, a dermoid cyst was encountered in the septum just above the columella. It was thin walled and measured approximately 1.5 centimeters in diameter.

As in the case of orbital dermoids, the treatment of those involving the nose is excision. When an external sinus is present the incision should include an elliptic region of skin around the sinus, which facilitates removal of the tract. In a great many cases extirpation of such tumors on the bridge of the nose is not without difficulty; not only are they often

Fig. 9. Dermoid cyst of floor of mouth and submental region.

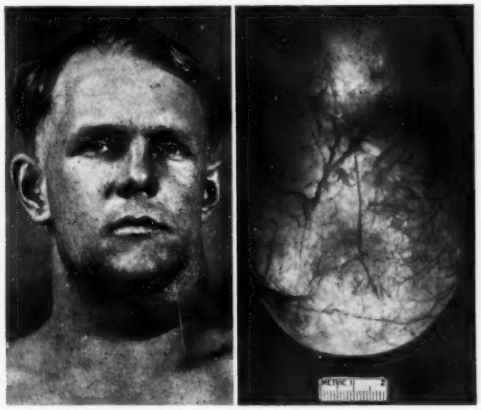

Fig. 10. a, left, Dermoid of submaxillary region extending into the floor of the mouth, and b, specimen removed at operation.

attached firmly to the underlying periosteum, but also have a tract or sinus of dermoid tissue that extends down between the nasal bones into the septum. When adherent, it is well to excise a portion of the periosteum in order to insure complete removal of the cyst. A tract between the nasal bones that extends deep into the septum offers a troublesome problem, as attempts to remove the surrounding bone and excise the tract result in much deformity. When excision is inadvisable, such a tract often may be removed by light cauterization with diathermy, a current of insufficient strength to cause sequestration of the adjacent bone being used.

DERMOID CYSTS OF THE FLOOR OF THE MOUTH AND IN THE SUBMENTAL AND SUBMAXILLARY REGIONS

As pointed out by Colp, the mylohyoid muscle, which serves as a diaphragm between the mouth and the neck, separates dermoids of the floor of the oral cavity from those occurring in the submental and submaxillary regions. When large, such cysts in the floor of the mouth bulge into the submental region, although they still are situated above the mylohyoid muscle. On the other hand, large submental and submaxillary tumors push this muscle upward in the floor of the mouth. We have seen 2 cases in which the dermoids originated in the floor of the mouth, but with gradual growth penetrated the mylohyoid muscle, passed between its fibers, and appeared in the submaxillary region. In 1 of these cases, a constriction formed by the diaphragm muscle could be seen at the junction of the upper and middle thirds of the cyst. This cyst measured about 10 by 7 centimeters.

At the clinic, 13 dermoids have been encountered above the mylohyoid muscle in the floor of the mouth, 9 below this muscle in the submental and submaxillary regions, and 2 passing between the muscle fibers of the mylohyoid muscle to involve the submaxillary region as well as the floor of the mouth.

The youngest patient in this group was 11 years of age, the oldest 59; the majority of these patients were operated on when between the ages of 15 and 35 years. In contrast to nasal dermoids, only 2 of this group of 24 tumors were present at birth; 1 was noticed in infancy and the 21 remaining first became evident when the patients were between the ages of 9 and 59 years.

The majority of these cysts occur in the midline and are elongated rather than round in shape. They varied in their greatest diameter from 4 to 10 centimeters, the average

diameter being between 6 and 7 centimeters. These cysts were remarkably free from hair, as in only 4 of the tumors was any hair to be found.

According to the histories obtained in these cases, the greater number of the patients had noticed a lump or swelling either in the floor of the mouth or below the chin for days, months, or even years before other symptoms occurred. In 2 cases, however, the patients were at first entirely unaware of the presence of a swelling, being conscious only of impaired articulation when speaking. In a few cases the swelling appeared suddenly and this probably was caused by infection. In 1 such case, in which the tumor involved the right submaxillary region and bulged into the right side of the pharynx, it was incised for a peritonsillar abscess. Several of these dermoids became infected, resulting in periodic attacks of acute inflammation with swelling; the cysts became very tense and ruptured either into the mouth or externally.

When these cysts swell to large proportions, either in the course of their natural growth or through infection, the tongue is often pushed upward against the palate; this causes difficulty in articulation, mastication, and deglutition. While dysphagia and dyspnea occur rarely, they are at times serious.

On examination of these patients, a swelling may be seen in the floor of the mouth or in the submaxillary or submental regions (Figs. 9 and 10). The tongue was often found to be pushed upward, in 1 or 2 cases to such a degree that it was impossible to obtain a view of the pharynx. On palpation these cysts had the characteristic doughy feeling. Some were rather soft, some tense, and in some, fluctuation could be elicited. In a few cases a sinus was present which discharged sebaceous or purulent material, either externally or into the mouth.

Dermoids in the floor of the mouth or in the submental and submaxillary regions must be distinguished from ranulas, cystic hygromas, cysts of the thyroglossal duct, chronic suppurative infections of the submaxillary salivary gland, branchial cysts, lipomas, and neurofibromas. The one notable feature which distinguishes a dermoid in these regions from the before-mentioned conditions is its "putty-like" or "doughy" feeling on palpation.

Extirpation of dermoid cysts above or below the mylohyoid muscle is the treatment of choice. The smaller tumors, which are definitely situated above this muscle, can best be removed through the floor of the mouth. A midline incision is employed which not only makes for a minimum amount of bleeding, but entails the least amount of trauma to the surrounding tissues. After a line of cleavage is established, the cysts are removed by digital or blunt dissection. In some instances in which there is excessive scarring about the tumors, which is caused either by previous attempts at removal or by infection, excision is very unsatisfactory. In such cases the tumor may be destroyed by cauterization of the lining by diathermy.

Large dermoids of the floor of the mouth that bulge into the submental region, and all such cysts lying in the midline below the mylohyoid muscle, can be excised through an incision in the submental region. In the submaxillary region the cysts are best removed by means of a transverse incision parallel to, and just below, the horizontal ramus of the mandible.

OTHER DERMOID CYSTS ABOUT THE HEAD AND NECK

As previously described, all but one of the dermoid cysts in group IV (Fig. 3) were situated at or near the midline. Four cysts in the suprasternal fossa ranged from 2 to 5 centimeters in diameter. Aside from gradual growth, they produced no symptoms other than occasional attacks of dyspnea and choking.

Near the midline, in the laryngeal region, 5 dermoids were encountered. With the exception of 1 which intermittently discharged a thin yellowish material, none of them caused the patients any discomfort. No sinus leading to the pharynx from any of these cysts was found, although such cases have been reported in the literature.

Two dermoids occurred in the occipital region. In each case the cyst was present at birth. One reached a size of 8 by 10 centi-

meters and the patient thought it caused severe headaches; the other was small but had a sinus which penetrated the skull.

The other cysts in this group were of no particular interest other than because of their situation to which reference has previously been made. All of these cysts were removed by excision.

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A STUDY OF OSGOOD-SCHLATTER DISEASE

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OSGOOD in 1903 and Schlatter in 1908 described a lesion of the tibial tubercle which bears their names and is generally recognized as a distinct clinical entity. Since the original articles were published many observers have attempted to expound the etiology, pathology, and treatment of the condition.

ETIOLOGY

Evidence is presented in the following paragraphs to demonstrate the causation of the lesion. For the most part the data used are derived from a series of 24 cases of typical Osgood-Schlatter disease which were seen personally by the author. There were 40 lesions in these cases. The source of other data is mentioned in the discussion. The 24 cases were studied by interrogation, physical examination, and roentgen-ray examination.

Many writers mention that rickets plays a rôle in the production of the lesion, yet in this series of cases there were none who had any of the cranial, thoracic, or long bone changes which follow rickets. Likewise, the parents in nearly all cases stated that the patients had received anti-rachitic diets and medication in early infancy.

In no case had there been an acute infectious disease preceding the onset of the lesion, except that one case had an acute respiratory infection 2 weeks before the beginning of trouble in the knee. In 17 cases the tonsils and adenoids had been removed years prior to the onset. It must be assumed then that neither acute infectious diseases, respiratory infections, nor infected tonsils bear any relationship to the condition.

Although all of these patients were asked specifically concerning pain in other areas of the body where osteochondroses are common, yet in no instance was there a patient who had ever had symptoms in these locations, and none had any physical evidence of such osteochondroses. In this series it would seem that the lesion is unassociated with osteochondroses in other areas of the body.

One patient was an obese person, another was undernourished; the remaining patients were of an average type, indicating that abnormal physical type had no bearing on these lesions.

A familial or hereditary tendency does not appear established in the etiology of the lesion, as there were only 3 patients with a familial history and none with a hereditary history.

Bursitis anterior to the tibial tubercle has been claimed by some to be the cause of the lesion. Evidence that this is not true is presented by the dissimilarity of the roentgenogram of a bursitis and that of Osgood-Schlatter disease. Figure 1, a, is a lateral roentgenogram in a case of bursitis, and Figure 1, b, is of a case of Osgood-Schlatter disease. In the former the soft tissue swelling does not involve the tendon but lies anterior to it, extending to the skin shadow, while in the latter the swelling is entirely confined to the patellar tendon, the interval between the tendon and the skin showing no swelling. This

From The New York Orthopaedic Dispensary and Hospital.

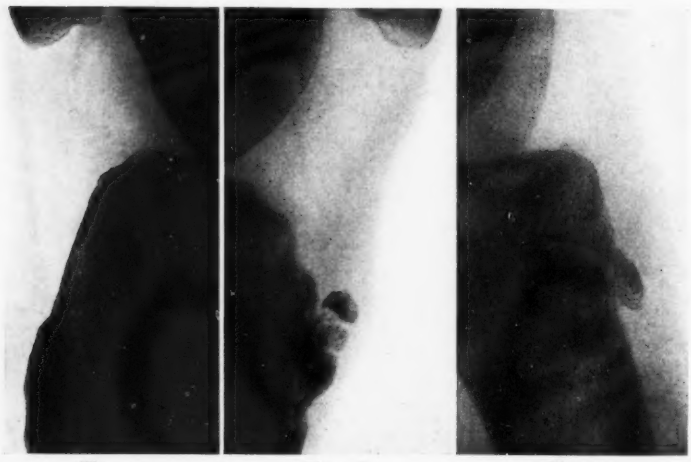


Fig. 1, a Fig. 1, b Fig. 2

Fig. 1. Roentgenograms illustrating the type of swelling in bursitis, a, and of Osgood-Schlatter's disease, b.
Fig. 2. The type of swelling anterior to the tibial tubercle in cellulitis.

evidence, as well as the fact that in 12 tubercles operated upon there was no evidence of a bursitis would lead one to the conclusion that inflammation of the bursa anterior to the tibial tubercle is not a causative factor in this disease.

A local infection at the tubercle or in close proximity to it has been stated as the etiological factor. We fail to agree with this view. The roentgen-ray appearance of such a lesion is unlike that of Osgood-Schlatter disease. Figure 2 is a lateral roentgenogram of a case of cellulitis anterior to the tibial tubercle in a child. The soft tissue changes are entirely different from those found in Osgood-Schlatter disease. There is no patellar involvement, nor are there any tubercle changes. In view of the dissimilarity of the roentgen-ray appearance of these lesions, and since there was not a positive wound culture of all lesions from which culture was taken, we feel that local infection plays no part in the production of this disease.

ETIOLOGICAL FACTORS

Osgood-Schlatter disease manifests itself at the age of puberty. This is the period of life when an individual's yearly increment in both ponderal and linear growth is the greatest. In early childhood there is a rapid linear growth, which is followed by a period of slower growth after the age of 3 years. Near the age of 12 years—in females a little before this—there is again a period of very rapid linear and ponderal growth. This stage extends through adolescence.

Linear growth takes place mainly in the lower extremities, and, according to Digby the upper and lower femoral and the upper tibial epiphyses contribute 23½ inches to the average complete linear growth of an individual. In comparison with the epiphyses in the upper extremity, those of the lower limb which have been mentioned grow more and at a much more rapid rate than do any other in the body, and their most rapid growth takes place during the period of adolescence.

Muscle and tendon growth. Linear growth of a muscle which is already formed is a response to traction exerted upon its origin and insertion. In other words, the rate at which a given muscle grows is controlled by the rate of growth of the bones to which it is attached. The muscle becomes stretched by epiphyseal growth, lengthens accordingly, and keeps lengthening until epiphyseal growth has been completed.

A tendon which is already formed lengthens at the expense of muscular substance, whether it be from the muscle tissue or from the connective tissue elements of the muscle. In order to determine the extent of linear growth of the patellar tendon, the author selected lateral roentgenograms of the knees of 10 normal individuals, all of whom were at the age of adolescence, and on whom lateral roentgen-ray examinations were made covering a period from 1 to 7 years between the first and last examination. The manner of measuring these tendons is shown in Figure 3. The length of the tendon was measured from the lower tip of the patella to a point on a line erected perpendicular to the axis of the fibula at the most superior point of that bone. The distance between *E* and *F* in Figure 3 denotes the length of the tendon. The results of these measurements were as follows: There was a 3 millimeter increase in the length of the patellar tendon in one tendon in 5 years. The remaining tendons showed either no increase, less than 3 millimeters, or an actual decrease in length between the first and the last examinations. This would indicate that the patellar tendon does not lengthen, or lengthens an infinitesimal amount, during the active growth period. Linear growth of this muscle tendon complex must occur from the quadriceps muscle and quadriceps tendon.

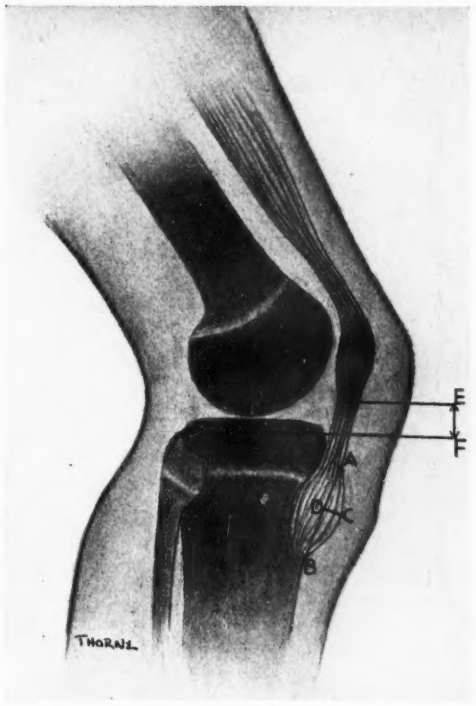


Fig. 3. Diagram illustrating the manner of measuring tendons used in this article.

The quadriceps muscle. This is one of the most powerful muscles in the body. Its origin is extensive, including the pelvis and a large portion of the surfaces of the femur. The area of origin is greatly out of proportion to the area of insertion, i.e., the tibial tubercle and expansions from the tendon to the tissue over and on either side of the tubercle. The muscle unit having the origin and insertion which it has is stimulated to grow in length by the three fast-growing epiphyses which have been mentioned. In response to their stimuli, the muscle tendon unit is placed in a greater degree of physiological tension during the age at which this disease appears than at any other period of life. The origin of the muscle is so extensive that tension is diffused, and therefore slight or no pathological process develops. The same tension is also transmitted to the area of insertion and, this being small, the stress is great. Pathological changes may be produced in this structure and the tendon and its attachment thereby rendered more susceptible to injury.

Trauma. Direct trauma to the region of the tibial tubercle was claimed to be the initiating factor in 11 of 40 lesions studied. Indirect trauma, such as running, jumping, or excessive walking, was stated as a preceding factor in 8 lesions, while of 19 lesions the patients or parents were unable to relate any antecedent trauma. Two of the patients were unable to give an accurate account as to the presence of trauma.

The fact that many of these lesions were initiated by either direct or indirect trauma seems to indicate that this plays some rôle in the etiology of the disease, yet the percentage of lesions, 47 in this series, which appears with no known trauma would lead one to feel that

Fig. 4, left. Illustration of the tendon swelling, the first roentgenological evidence of Osgood-Schlatter's disease, right, and swelling with calcification, left.

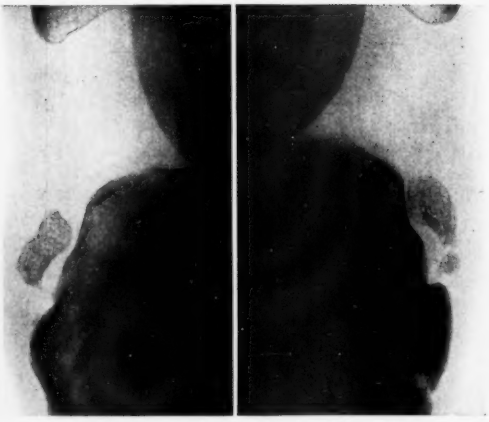


Fig. 5. Later roentgenograms of the knees of the same patient shown in Figure 4. Large bone islands are present in either tendon.

trauma is not the ultimate causative factor. Sixteen of the patients had bilateral lesions, 66 per cent of the entire series. It is inconceivable that traumatism alleged to have caused the lesion in one knee would have affected the other knee at the same time in anything like this percentage of cases. This is strong evidence that the rôle of traumatism is to aggravate or call attention to the lesion rather than to produce it.

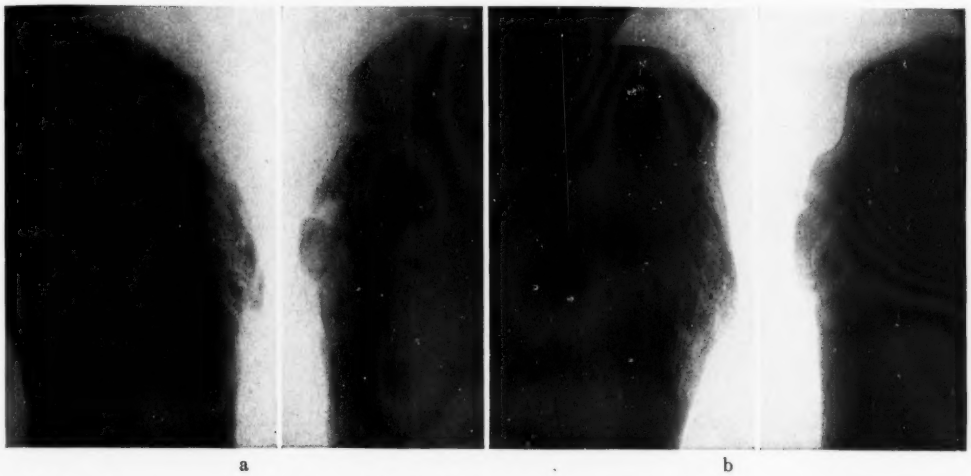
Significance of Hooke's law in Osgood-Schlatter disease. According to Hooke's law, Wertheim gives the moduli of a number of substances in grams weight per square centimeter. He states that elastic fibrous tissue, arteries and veins have a more marked decrease in strain stress than do substances such as bone or tendon tissue which are inelastic. Stresses which are applied by the quadriceps muscle will cause an initial damage to the elastic tissues of the tendinous attachment of the patellar tendon, as well as the small vascular channels within the tendon and the attachment, before damage takes place within the bone.

Blood supply to the tibial tubercle. Until the tibial tubercle has united with the diaphysis of the tibia its blood supply is furnished partly by the epiphysis of the tibia but to a greater extent by the overlying network of blood vessels supplied by the tissue of the patellar tendon attachment. These blood vessels perforate the thin cortical substance of the tubercle. Little or no blood is supplied to the tubercle from the diaphysis of the tibia until after bony union between the two has taken place, because the epiphyseal cartilage of the tubercle acts as a barrier.

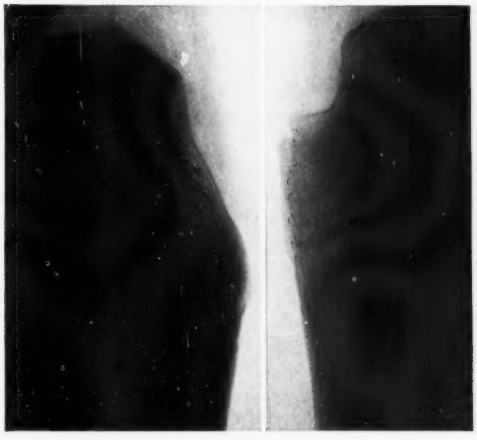
If the patellar tendon and its attachment are altered from the normal, and if the blood vessels within these structures are changed, the tubercle of the tibia may be altered and the changes take place within the tendon which one generally ascribes to Osgood-Schlatter disease.

Seasonal influence on Osgood-Schlatter disease. A significant finding in the series of cases studied was the fact that in only one had the lesion manifested itself during the summer months of the year. Twelve patients stated that disability had started in the fall, and in 4 cases the onset of disability had been in the winter, while 4 other patients began to have trouble in the spring. Three patients were not able to give an accurate enough history as to the season of year when disability was first noted.

This striking seasonal influence on the onset of disability from this lesion might be explained by the fact that these patients are more active in the spring, summer, and fall months, as well as that more rapid growth



a b



c

Fig. 6. a, Appearance of fragmentation which is often present in the tibial tubercle. b, Disappearance of fragmentation with repair. c, Repair complete.

takes place in summer. The seasonal increase in growth and activity may be the basis for abnormal stresses which are placed upon the patellar tendon and which will gradually increase toward the fall. If a pathological process of the tendon is started it may be weeks or even months later that the child has symptoms.

ROENTGENOGRAPHY OF OSGOOD-SCHLATTER DISEASE

Tendon enlargement. This is the earliest roentgenological finding in this disease. In Figure 4 are shown the lateral roentgenograms of a patient's knees. This patient, Case 1 in the series, entered the clinic at the age of 13 years complaining of pain over the tibial tubercles, of 3 years' duration. Neither direct nor indirect trauma had initiated these lesions. The roentgenogram shows enlargement of the tendon on either side but with no tubercle changes or calcifications within the tendon on the right. Neither of the tubercles was hooked. Figure 5 shows the same case 2 years later. The tubercles were slightly enlarged and there was a large bone island in each tendon. Each tendon still shows a marked degree of enlargement. Other similar roentgenograms could be shown to substantiate the fact that tendon enlargement precedes other findings which are noted in roentgen-ray examination of this lesion. The fact that in many cases one is unable to elicit trauma as an initiating factor in the lesion indicates that the disease can occur without trauma, and may occur as the result of intensified physiological strains which are placed upon the tendon and its attachment. As will be mentioned later, the enlargement of the tendon is a constant feature in this lesion, and, also, the enlargement may involve the entire tendon.

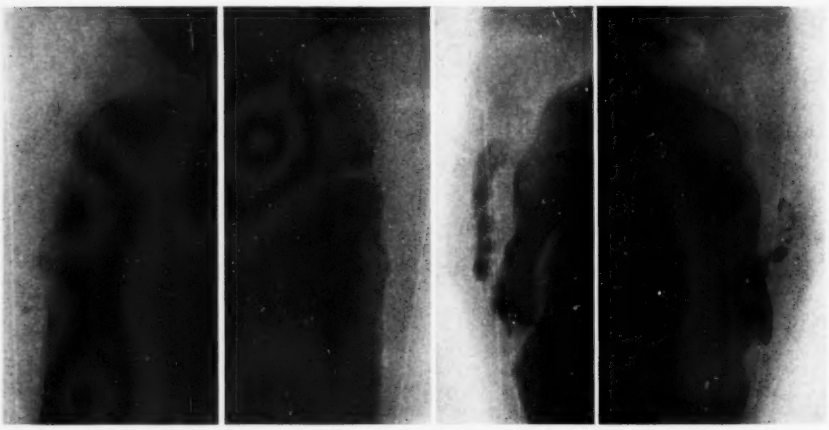


Fig. 7. a, left. Illustration of the roentgenological changes in an early case. b, Later changes in the same case.

Tubercle changes. Roentgenographically there is no proof that hooking of the tibial tubercle is a constant feature in this disease. Also, in a study of lateral roentgenograms of tibial tubercles, one finds many instances of so called hooked tubercles when the individual has not and never has had symptoms of Osgood-Schlatter disease.

Separate centers of ossification of the tibial tubercle were not present in any of the cases studied, so one must conclude that these are not factors in the causation of the lesion, nor are they a pathological finding later on in the disease.

In some cases the pathological processes at work within the patellar tendon are able to produce changes in the tibial tubercle visible roentgenographically. An example of the manner in which the tibial tubercles can be affected in this disease is illustrated in Figure 6, a, lateral roentgenograms taken on admission. Slight tendon enlargement is shown

Fig. 8. a, left. The pre-operative roentgenograms of an operative case. b, A complete dissolution of the tubercle on the right after operation.

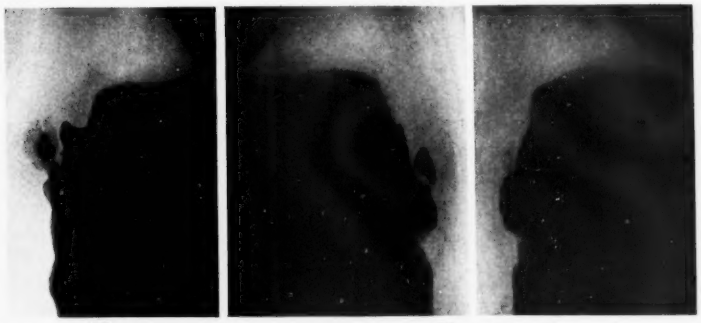


Fig. 9 Fig. 10

Fig. 9. Residual bone island and irregular tubercle resulting from Osgood-Schlatter's disease.

Fig. 10. Pre-operative roentgenograms of patient's knees from which specimens were taken, which are described in the article.

and the tubercles have the appearance of fragmenting. Figure 6, b, shows the same knees 6 months later. The architecture of the tubercles has become more regular. Roentgenograms of the same lesions 5 years after the first were taken (Fig. 6, c) show that the tubercles have united with the shaft of the tibia, the architecture of the tubercles is normal in appearance, and each tubercle is enlarged.

Ossification of the tibial tubercle is not essential in the formation of this disease, although in nearly all cases the tibial tubercles were ossifying. The patient in Case 4 in the series was a boy aged 12 when he entered the clinic for the first time. He had struck his right knee 3 weeks before admission. His complaint was pain about the tubercle. Later in the same year he started to have pain over the left tubercle. The trouble on this side had started gradually and without any obvious cause. Figure 7 shows the roentgen-rays of this patient's knees on admission, a, and two years later, b. The former shows a moderate amount of tendon enlargement on the right with slight calcifications within the tendon at its attachment, and the tubercle just starting to ossify. On the left the tubercle was not present, but there was slight tendon enlargement, an indication that the disease would eventually cause symptoms on this side. The later film shows the usual x-ray findings in both sides, and the tubercle has appeared on the left.

As a result of operative interference complete and permanent dissolution of the tibial tubercle can occur. The first case in the operative series illustrates this. The tendons on both sides were split longitudinally, drill holes were made through each tubercle to the tibial shaft, and bone pegs were placed within these holes. Figure 8, a, shows the lateral roentgenograms of this patient's knees before operation, while b, represents the roentgenograms 2 years later. In the latter the tubercle on the right has entirely disappeared, while the one of the left is quite regular and normal, and the degree of tendon enlargement can be seen to be lessened. This patient was entirely relieved of disability a few weeks after operation. The case not only proves that the tubercle can disappear as a result of operating but also indicates that the tubercle is not essential for the maintenance of normal function of the quadriceps muscle. A logical explanation of the dissolution of the tubercle in this case is that as a result of the operation circulation to the tubercle was altered.

Calcified and ossified islands. After enlargement within the patellar tendon has taken place, secondary changes may occur in the form of calcifications. After the small areas of calcification appear one is able, in later roentgenograms, to see ossification occurring where there was a previous island of calcification. In Figures 4 and 5 this is well illustrated. Figure 4 shows the enlargement of

Fig. 11. Photomicrograph showing the specimen, taken from patient whose roentgenograms are shown in Figure 10. Specimen came from right side. ×8.

either patellar tendon, with a small area of calcification on the left, and with neither calcification nor ossification on the right. Figure 5, a later roentgenogram, shows large bone islands in both tendons, the one on the left occupying the position of the calcified area in Figure 4, while on the right a bone island is present where neither calcification nor ossification was visible before. Calcification in this lesion must have occurred as the result of pathological processes within the tendon. Following this these areas are converted to ossified islands.

Bone islands within the tendon may disappear but in some instances they remain. Figure 9 is a lateral roentgenogram of a patient, 24 years of age, in which one can see the large ossified islands as well as the marked irregularity of the tubercle. The patient had entered the clinic at the age of 16, when a clinical and roentgen-ray diagnosis of bilateral Osgood-Schlatter disease had been made. At this time only small calcified and ossified islands were noted by roentgen-ray.

PATHOLOGY OF OSGOOD-SCHLATTER DISEASE

In the discussion of this phase of the disease three specimens will be described. Two of these specimens are from one individual, a boy

Fig. 12. Photomicrograph showing the tendinous attachment in the normal.

of 15 years, who complained of trouble in both knees 8 months prior to the time operation was done. The onset of trouble was without any known trauma. Roentgenograms of this patient's knees are shown in Figure 10. On the left side the patellar tendon is enlarged and there is a small calcified area within the tendon near its attachment to the tibial tubercle. On the right side tendon enlargement is seen, and also a large bone island is present within the tendon. On the left side a sagittal section was removed in such a manner as to include the tendon, the tubercle, and its cartilage, and a portion of the diaphysis of the tibia. On the right side a section was removed including the bone island. Figure 11 shows the section taken on the right. Not only can the bone island be seen within the substance of the tendon, but it is entirely within the tendon. The tubercle is seen on the lower side of this specimen.

In Figure 12 is shown the manner in which the patellar tendon attaches to the tubercle in the normal. This specimen was removed from a patient aged 13 years. The tendon was composed of fibrous tissue arranged in an orderly manner, with the attachment to the tubercle being relatively smooth and regular. The tendon fibers were closely packed together, with few blood vessels in the substance of the tendon at the attachment to the tubercle. The number of cells was not increased above the normal of tendon tissue, and no fibrocartilaginous areas were present within the tendon or at the attachment.

Fig. 13.

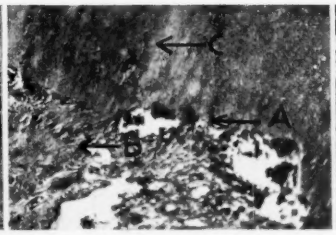


Fig. 14.

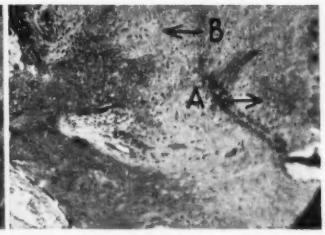


Fig. 15.

Fig. 13. Cartilaginous areas within the tendon, *A*. Note the irregularity of tendon fibers. ×82.

Fig. 14. The junction of the tendon with the tubercle in a case of Osgood-Schlatter's disease. *A*, Denotes the junction, *B*, the cellular bone of the tubercle, and, *C*, denotes the area of fibrocartilage described in the article. ×82.

Fig. 15. A photomicrograph of a portion of the bone island shown in Figure 11. Area of calcified cartilage, *A*, and fibrocartilaginous ring about bone island, *B*. ×82.

In the case of Osgood-Schlatter disease the tendon fibers are arranged rather loosely and with spaces between fibers and with areas of fibrocartilage within the substance of the tendon, as is shown in the photomicrograph illustrated in Figure 13. The degree of vascularity within the tendon itself is also moderately increased.

The attachment of the tendon to the tubercle is very irregular, and, instead of tendon fibers passing directly to the tubercle as is seen in the normal, there is an area of fibrocartilage between the tendon and the tubercle. This might account for the increase in size of the tubercles in this disease as later this cartilage becomes ossified. There is a marked increase of cells at the attachment of this fibrocartilage with the tubercle as is illustrated in Figure 14, and plasma cells, lymphocytes and young fibroblasts are present. There is a great increase in the degree of vascularity at the junction of the cartilage with the tubercle.

As has been mentioned before, the islands one sees in this lesion are within the tendon. Microscopically the bone constituting these islands is more cellular than normal bone. About the margins of the bone itself there is a definite zone of fibrocartilage as can be seen in Figure 15, from which the bone is being formed. The tendon about the area of fibrocartilage is very vascular and cellular. Near the bone island, in one place, an island of fibrocartilaginous cells was found, in the matrix of which the presence of calcification was noted (Fig. 15).

CLINICAL STUDY

One hundred and thirty-six patients with Osgood-Schlatter disease entered this clinic between the years 1923 and 1933. Twenty-four of these patients with admission and follow-up roentgenograms, were seen by the author. Twenty-two of these patients were males and 2 were females. The average age on admission of the former was 13, the eldest being 19 and the youngest 10. The 2 females were aged 10 and 11 on admission. Of the entire series of patients with this disease seen at this clinic nearly all the females were much younger than the males. This fact might be explained by the more rapid increase in linear growth in females, thus leading to the presence of the lesion at an earlier age in females.

The symptoms complained of by patients suffering from this lesion are well known. Pain over the tibial tubercle when walking, with an increase of pain on running or climbing stairs, is one of the most constant symptoms. Perhaps the most important symptom is the disability which these patients experience when they endeavor to carry on athletic activities. The degree of athletic activity was not severely limited by symptoms in any of the cases of this series. Moderate limitation was complained of by 16 patients, while 4 patients were slightly handicapped, and 2 had no limitation. Two patients were limited in activities as a result of residual paralysis, due to poliomyelitis of the opposite extremity rather than to the lesion in the sound limb. The percentage of patients with Osgood-Schlatter disease and with paralysis of the

opposite extremity is relatively high in this small group; however, these 2 cases are the only patients with the two conditions in the entire number of patients with Osgood-Schlatter disease who came to the clinic for treatment.

In 16 patients there were bilateral lesions, and 8 patients had unilateral involvement.

TREATMENT

Nineteen of the patients were treated by various conservative measures which consisted for the most part of daily massage of the affected region, limitation of activities, and partial immobilization of the knee by ace bandages. In no case was a cast used in treating these patients.

Five of the patients were operated upon, and to these are added 4 others not seen personally by the author. In the 9 operative cases, 12 tubercles were operated upon. In 8 of these the tendon was split in a longitudinal manner, reflected to both sides of the tibial tubercle, and drilling into the tibial diaphysis was done. In 4 tubercles the tendon was not reflected, the drill holes being made into the tubercle through small slits in the tendon. In 4 instances the tubercles were pegged by placing small bone chips in the drill holes. These chips were removed from the shaft of the tibia. All wounds were closed in layers, with plain gut sutures to the deep tissues and running silk sutures to the skin. Dry dressings and flannel pressure bandages were applied to the operative area.

Sutures were removed from the wounds in 10 days. The patients were allowed up as soon as the sutures had been removed, and they were discharged from the wards 2 to 3 weeks after operation. In no case was there any postoperative complication. Daily massage of the affected area was begun as soon as sutures had been removed, and the patients were started on active knee motion at the same time.

CLINICAL FOLLOW-UP

The average follow-up period in the non-operative group of cases was 5 years, the shortest period being 3 years and the longest 10. Twelve of the patients were entirely free from trouble when they were seen in follow-up clinic. The average age when disability had entirely disappeared was 14. The average interval from the time when these patients started to have symptoms until they were entirely relieved was 2 years and 3 months. The longest period of disability was 4½ years and the shortest was 7 months. Seven of the patients still had symptoms due to the lesion when last seen. The symptoms were very mild, usually being pain over the tubercles on kneeling or pain in the same area in strenuous activity. Two of these patients were in their early twenties, 2 in their late teens, and 3 were 15 years of age.

In the operative group of cases the average follow-up period was nearly 3 years, the longest period being 5 years, and the shortest 1 year. Seven of these 9 patients were entirely free from any symptom, and the interval of time between operation and complete relief was from 4 to 6 weeks. Two patients continued to have disability of the same type as before operation, 1 of them 2 years, the other 1 year, after operation. Both of these patients were 16 years of age when last seen. In both cases drilling and bone-pegging had been done. In one instance the tubercle had been drilled through small slits in the patellar tendon, and in the other a long longitudinal split of the tendon had been done.

ROENTGENOLOGICAL DATA OF CASES STUDIED

Non-operative series. The tubercle of the tibia may be of varying degrees of enlargement following this lesion, and in some cases there is no appreciable enlargement. Five tubercles in the non-operative group of 31 were not enlarged roentgenographically on follow-up examination, 14 showed a moderate degree of enlargement, 9 were slightly enlarged. Two tubercles, poliomyelitis patients, are not included. Eighteen tubercles had united with the tibial shaft when seen on follow-up examination; the remaining tubercles had not united. Two patients with ununited tubercles still had trouble in the region of the tubercles; the remaining cases in which the tubercles had not united were free of symptoms. This illustrates the fact that union of the tubercle with the tibial shaft is

not essential for the relief of symptoms. Conversely, the fact that 5 patients whose tubercles had united with the shaft still had symptoms would indicate that union of the tubercle with the shaft does not cause relief of symptoms.

Calcified or ossified areas were present in 19 non-operative tendons on admission to the clinic. In follow-up roentgenograms there were 25 tendons showing these islands. A bone island was present in one tendon in the admission roentgenogram but had disappeared when the last roentgenogram was taken. Four tendons were without either calcified or ossified areas in both admission and follow-up roentgenograms.

Thirteen tubercles had the appearance of fragmenting in their first roentgenograms, while on the last examination none had this appearance.

All operative cases. Eight tubercles of the 12 which were operated upon were slightly enlarged, as indicated by the first roentgenograms. Nine of these were slightly enlarged in follow-up roentgenograms, 1 was severely enlarged and 1 moderately. One tubercle operated upon showed no degree of enlargement. This would indicate that operative work has little effect upon the future size of the tubercle.

Seven of the 12 tubercles had united with the tibial shaft in follow-up roentgenograms. Four tubercles had not united with the shaft, while one tubercle had been entirely absorbed. Two of these patients had symptoms on follow-up examination. Many of the operative cases had roentgenograms taken at periods following their operations. In them the tibial tubercle did not unite with the shaft for many months and sometimes years. This, coupled with the fact that many patients were relieved in such a short period after operation, leads one to the conclusion that union of the tibial tubercle with the tibial shaft is not necessary for the relief of patients suffering from this disease.

Calcified or ossified islands in the tendon were a feature in 6 cases before operation, and at the last examination of these patients 10 tendons showed areas of ossification. It appears, therefore, that drilling and pegging of these tubercles has no effect upon the disappearance of these islands, nor do the islands give symptoms, since many patients with them were without symptoms after being operated upon.

TENDON CHANGES

The manner of measuring the patellar tendons is illustrated in Figure 3. Two places for measuring the total diameter of the tendon were taken. One place was immediately below the lower pole of the patella, and the other was at the superior margin of the tibia, or at *A* in Figure 3. In discussing these measurements the former will be spoken of as the patellar measurement, and the latter will be called the tibial measurement, of the tendon. In order to determine the amount of enlargement in the anterior part of the tendon a point, *A*, was taken on the proximal anterior surface of the tendon where it was of uniform diameter. Another point, *B*, was taken anterior to the shaft of the tibia where the tendon faded into the covering membrane of that bone. These two points were connected by a straight line. The distance *D-C*, from a point on the line to the anterior surface of the tendon, was measured. This denoted the maximum swelling of the anterior portion of the tendon, and will be spoken of as tendon swelling in the discussion.

A series of 25 normal tendons was measured in the same manner. In this series the ages of the patients ranged from 8 to 19, a fairly representative series corresponding with the age at which this disease appears.

Normal series. The average diameter of the patellar tendon, or the patellar measurement, was 5.7 millimeters. The narrowest tendon at this point was 3 millimeters and the greatest was 9. The average diameter of the tendon at the tibia, or the tibial measurement, was 5.7 millimeters. The smallest and largest diameters were the same as for the patellar measurement. There was no tendon swelling anterior to the line *A-B* in 20 cases. In 2 there was 2 millimeters of swelling, in 2 others 1 millimeter of swelling, and 1 had 3 millimeters of swelling.

Non-operative series. The average admission diameter of the patellar tendon at the

patella was 7 millimeters, the minimum being 4, and the maximum 11 millimeters. The average diameter at the tibia was 8.5 millimeters, with a maximum diameter of 15, and a minimum of 5 millimeters. The average tendon swelling anteriorly was 6 millimeters, the minimum being 2, and the maximum 9.

In follow-up roentgenograms the average diameter of the tendon at the patella was 7 millimeters, and at the tibia it was 6. The average amount of tendon swelling was 5 millimeters.

Operative series. The pre-operative measurements of this group were nearly the same as those of the non-operative series. The average patellar diameter for this group, in follow-up roentgenograms, was 9 millimeters, and at the tibia the average diameter was 9. The average tendon swelling was 8 millimeters.

The above data indicate that the patellar tendon retains a degree of enlargement throughout its entire extent after the symptoms of the disease have subsided. There are, however, some tendons which return to a normal diameter. All of the operative tendons increased in diameter after operation.

SUMMARY

The relief of symptoms in series of cases by other observers who have operated upon these lesions has been attributed to the fact that the tubercles, by drilling and pegging, unite with the tibial shaft by premature bony or fibrous union. It has been proved by this series that premature bony union does not take place as a result of such operative procedures, as well as by the fact that a few patients were relieved of trouble without operation and before bony union could have occurred. A fibrous tissue union with the diaphysis of the tibia is also an illogical explanation of the manner of relief after these patients are operated upon. The small amount of fibrous tissue which might conceivably form within the drill holes would hardly be sufficient to anchor the tubercle if separation had occurred. Also, the fact that in many non-operative cases relief is secured by conservative means is evidence that this type of union does not occur. Another proof that premature union of the tibial tubercle is not a necessary procedure in relieving these patients is demonstrated by the fact that in one case of this series the tubercle entirely disappeared in a few months after operation, and yet this patient was relieved of trouble in a few weeks.

It is our feeling that the symptoms of which these patients complain are due to a swelling of the patellar tendon and its attachment. The pathological processes which cause this swelling have been mentioned. By splitting the peritenon and incising the tendon, intratendinous pressure is released. The tendon is thereby able to bulge through the incision, and the pain which is caused by increased pressure within the tendon is relieved, much in the same manner as pain is relieved when one incises an abscess.

Since this article was written three patellar tendons were split in two patients suffering from this disease. A complete description of these cases will not be given here but will be reported when more cases have been added to them. The two patients were discharged 2 weeks after operation and on their first visit to the clinic, 3 weeks after operation, they had no tenderness over the tibial tubercle, they carried on a normal life, and were entirely free of the disability present before they received treatment.

CONCLUSIONS

1. Rapid growth during adolescence is the underlying cause of Osgood-Schlatter disease.

2. During the period of rapid growth the quadriceps muscle is placed under greater physiological strain than at any other period of life. This increase of strain may produce changes within the patellar tendon which can be recognized roentgenographically. The tibial tubercle can be altered by these changes within the tendon because the blood supply to that structure is changed. The roentgenographic appearance of the tibial tubercle in Osgood-Schlatter disease is based upon the altered circulation within the patellar tendon and its attachment.

3. Fibrocartilaginous areas appear in the patellar tendon in this disease, and they are the result of traumatisms within the tendon.

These areas become calcified and later ossified, and these changes can be seen roentgenographically.

4. The disability experienced by patients with this disease is due to an increase in intratendinous pressure. Release of this pressure by slitting the tendon will relieve the individual. If conservative treatment is maintained the peritenon adapts itself to the increased size of the tendon and eventually disability disappears.

5. Conservative measures should be used in treating patients seen in the late stage of the disease. Slitting of the tendon is advised if patient is seen near onset of the disease.

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ACUTE APPENDICITIS WITH PERITONITIS

Treatment and Mortality

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THE desire to contribute to the clinical care of serious cases of acute appendicitis with peritonitis, to describe the methods whereby a low mortality has been gained, and to discuss other general surgical factors contributing to mortality percentages, has prompted this discussion.

When we realize that a long known, well understood, diagnosable, localized disease treated by recognized methods and curable, still carries a death rate of 15.2 per 100,000 of population—that rate being nearly doubled in the past 20 years—we must search for the cause of this mortality. Add to this the fact that, in cases with peritonitis, there is an operative mortality of 5 to 30 per cent for which the surgeon must accept a large part of the criticism, we ask ourselves, where is the trouble?

In a case of abdominal pain, not only the laity but too frequently the physician suggests delay, catharsis, and the use of morphine—the arch enemies of the patient, and when finally the patient reaches the hospital after a late diagnosis of acute appendicitis with peritonitis, a resident or junior inexperienced visitant too often is assigned to the case. An abdominal pain should be considered appendicitis until otherwise proved, and the most experienced surgeon available should operate unless another well trained in his methods is available. J. M. T. Finney, Jr., produced statistics to show that the mortality in acute appendicitis complicated by peritonitis when handled by visiting surgeons was practically the same as that when the operations were done by residents. It seems to me that Finney's mortality rate as reported is too high and is the result of a wrong conception of treatment by both visitants and residents. When a surgeon opens the abdomen on any diagnosis, he should have the training to meet any condition found. If, as Finney concludes, an incompletely trained surgeon can handle acute appendicitis with as low a mortality as that of the experienced surgeon, why all the painstaking methods to train surgeons and why should 3 to 7 or 8 years be required in such a training if the mortality and operative results in such a disease are not improved? Being thus burdened with principles, I operated upon the patient or closely supervised operation in every case of this series.

Group statistics determine general results only; it is necessary to study uniform individual methods practiced by an individual surgeon in order to appreciate results. The operation itself, although it may ruin the patient's chances, may still be but a part of the cause of mortality and any one of the three stages—diagnosis, operation, and postoperative care—may improve or ruin the results. Each surgeon may plan his technique, partly from group statistics, but, as in the present problem, he must have as well his own well grounded conceptions of pathology, diagnosis, course, and treatment.

In the period from 1913 to 1923, the author treated in Cleveland City Hospital 156 patients with appendicitis with gangrenous or ruptured appendices; patients with well marked peritonitis requiring drainage. This hospital had, at that time, a capacity of about 1000 beds and received the usual run of patients with advanced or neglected disease who go to such institutions. In the histories there were commonly mentioned not only delay but the use of catharsis and morphine. This series included *all* such patients admitted during the same 4 winter months for 10 years thus making a good cross cut of appendicitis occurrence and removing the factor of a favorable series. The group includes all serious cases of acute appendicitis with peritonitis requiring drainage, but it does not include the large number of cases of acute appendicitis not requiring drainage, or subacute or recur-

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ring appendicitis, or cases in which appendectomy was done during an abdominal operation for other causes. In these so called clean appendectomies, there were no deaths due to the operation.

During this period in 4 other hospitals, there were in the author's service 61 of the same class of cases, making a total of 217 cases of acute appendicitis with peritonitis requiring drainage. In these two groups totaling 217 cases, there were 5 deaths, a mortality of 1.84 per cent.

Closure of the abdomen in the presence of pus with peritonitis, in our judgment, is bad surgery, so that this series includes no such case but only those in which our judgment dictated drainage.

How have the results in this series of cases been gained? In a search for the causes of the higher mortality, some simple surgical principle may inadvertently be overlooked. For this reason, early in our practice we adopted certain rules of procedure.

Immediate operation in *every* case on the diagnosis of appendicitis. No possible excuse —professional, social, holiday, or other engagement—was permitted to break this rule. At times this has resulted in some privations, but it has been followed. We are well aware of the old Ochsner treatment: delay in certain advanced cases to permit the localization or walling off of an abscess or the building up of immunity; the excuse that the patient is not suitable for operation or that other diseases may be present; the question of age and intercurrent disease. We have come to believe that such factors are negligible and that operation should be done at once on diagnosis. In some cases, simple incision and drainage may be all that is indicated but immediate operation is the procedure of choice. Local anesthesia, infusions of salt solution before, during, and after operation together with the Alonzo Clark postoperative care make immediate operation in all cases the safest procedure. Delay is common enough before these patients are seen by a competent surgeon. Why should the surgeon delay still further? While the practitioner or consultant has his attention focused to find the relatively few cases which he considers as suitable for late operation, delay becomes the custom and the fatal complications develop. A questionable delay held as best in a few cases further *jeopardizes the many*. Again those few patients, say 10 per cent, in which it is claimed delay in operation will enable resistance to develop or walling off to occur, will not be harmed but will be benefited by an accurate, non-shock producing operative procedure which, with the slightest trauma, relieves the source of peritoneal infection.

TECHNIQUE

Anesthesia. Nitrous oxide gas and oxygen with ether if necessary has been the routine anesthesia. In toxic cases and in those complicated by other serious disease, e.g., pneumonia, heart conditions, local anesthesia by block and infiltration has been used.

Routine. A ruptured appendix may present one of the most difficult, nice operations of the abdomen. Localization and access to the appendix, prevention of contamination of loops of small gut, non-disturbance of the gut, delivery of the appendix without rupture or further spread of infection; when, how, and what to use as drainage; respect for the peritoneum; the non-disturbance of intraperitoneal pressure—all these steps present their problems. The delegation of a "pus appendix" to any but the best experienced available surgeon is wrong, yet this is too frequently the custom. Familiarity breeds contempt.

A saline infusion, either subcutaneously or intravenously of 1000 to 1500 cubic centimeters was given to adults (children in proportion) before or during operation. A short, 3 inch or less, intermuscular incision was made. The old practice of walling off with gauze tapes or rubber dam we have never practiced since it seems perfectly obvious that pus and infection are thereby carried into the areas we wish to protect and thus brought into contact with loops of small gut. Likewise bulging of loops of small gut into the wound was prevented, possibly by having a very few inches of gauze always visible in the wound. Through the small incision pus or seropus escapes or is sucked. The cecum or loop of small gut tends to present into the wound, thus partially closing the peritoneal cavity without changing the normal intra-abdominal pressure. Inspec-

tion or exploration is never attempted. Knowing that about 66 per cent of appendices are retrocecal or retrocolic, the surgeon passes the exploring index finger first lateral to the cecum where in these cases it encounters the familiar feel of the thickened appendix and inflammatory tissue; or he guides the finger along the trough over the iliac vessels where the pelvic appendix is found in 31 per cent of cases. In both situations the cecum is displaced toward the midline, the appendiceal mesentery and appendix being carefully handled. Rough handling of the appendix or cecum does not occur and the danger of pylephlebitis is prevented. Thus we have neither carried infection elsewhere nor sought to determine the extent of the peritonitis. If we are able to state accurately that a general peritonitis is present we have markedly reduced the patient's chance of recovery.

The appendix may be simply ligated or preferably, by means of a double pursestring suture, inverted, if the condition permits, but never both. In one early case of simple appendicitis not here included, in which *ligation and pursestring suture* were both practiced, an abscess developed between the ligation and the inversion and required a secondary operation. In 4 cases only, the appendix was not removed. When a ruptured appendix is left and drainage is established there is a constant potential or active reinfection of the local peritoneum which contributes to extension of the peritonitis.

Drainage. A very old problem. *What is gained by closure of the abdomen based purely upon unsubstantiated theories of peritoneal resistance, except a risk!* Recent statistics by Bauer, covering a very large group—1000 cases of appendicitis with peritonitis closed without drainage—still gives a mortality too high for such cases. Limitation of the extension of infection by drainage seems always indicated. Reverse lymph flow of whatever duration (Horsley) aids in such an elimination. If the lymph current is reversed, as when stimulated by a foreign body, better elimination occurs and better localization. At least until there is available an efficient peritonitic serum or vaccine the peritoneal abscess should be drained as any other abscess. While we are studying by clinical experience the possibilities and in what conditions the peritoneum may be closed, the general mortality goes up. It has been our custom to drain[1] in all such cases. A drain is always placed deep into the pelvis. One may also be placed to the stump of the appendix or retrocecally, or, in the worst cases, on the left side into the pelvis. Care should be exercised that the drain does not press upon the large vessels, ureter, or loop of gut. Erosion of vessels (2), vein (1), artery (1), tube on a loop of small gut (1), have been seen. Cigarette drains and rubber tissue, easily collapsible by muscle or suture pressure, are worthless, if evacuation is desired. I have seen an instance of fatal residual abscess due to a cigarette drain acting as a plug. Reasoning that a drained cavity becomes walled off within 24 to 36 hours and that therefore the drain may be safely removed, several times after removal of a drain we have seen the abdominal wall and skin seal, thus causing a residual abscess requiring drainage. Therefore, until the temperature has touched normal and the patient is out of danger, we leave in all drains, loosening or shortening them from time to time.

Drainage of peritoneal abscess. It seems entirely unreasonable to leave a collection of pus or seropurulent fluid in any part of the peritoneal cavity no matter what are the apparent resistance of the patient and the absorptive power of the peritoneum. The patient's resistance may be high. Why not use it as an advantage instead of an experimental attempt to find out how much he can resist if the peritoneum is closed? A fluid collection may become walled off, may become purulent, may form a focus for lymphatic extension, venous thrombosis and extension, may very greatly increase in volume even to filling the left peritoneal fossa to above the navel as seen in a child of 7 years.

Postoperative care. The postoperative care begins even before operation. Intravenous saline glucose infusions of 1000 to 2000 cubic centimeters and morphine to the physiologic limit in one or two doses if there is unavoidable delay before operation, are given.

[1]The ideal drain consists of a 1 centimeter, notched soft rubber tube, with a loose wick of gauze through it which gives both capillarity and tube space.

Pitressin has given sufficiently good results and is on a sufficiently proved basis to be used both before and after operation in selected cases. After operation nothing is given by mouth, but intravenous saline or saline and glucose, 4000 to 6000 cubic centimeters is given, every 24 hours; morphine is administered until respirations are 14 to 16 and the pupils are moderately contracted; gastric or duodenal lavage is used following vomiting or regurgitation—these procedures together with extreme vigilance and frequent observations to detect the first signs of trouble, constitute the invariable treatment.

My attention has occasionally been called by the resident to a rapid pulse, anxious facial expression, and abdominal distention as evidences of an extending peritonitis. Regurgitant type of vomiting, a little brownish stain to a handkerchief, to the corner of the patient's mouth or on the bed sheet, together with epigastric distention, tell the often overlooked story of fluid intake by mouth and a gastric dilatation which, if repeated lavage or continuous evacuation of gastric content is not carried out by a retained tube, may prove fatal.

Morphine without atropine results in a contracted tubular type of gut; it lessens or obliterates peristaltic waves (Sollmann); and through intestinal muscle contraction, it gives support to and lessens the volume of the intestinal circulation. Morphine, therefore, prevents intestinal circular muscle relaxation, vascular dilatation, increased blood supply, and increased retention of blood in the intestinal capillaries. Increased blood content of the intestines results in diffusion of the blood gases into the gut with greater distention. The gas producing group of organisms adds to this distention. It has been shown that this intestinal gas has about the same carbon dioxide content as has expired air, hence the gut, in a condition of paralytic obstruction, acts in the nature of an expiratory organ. At the same time, with this increased blood content, the toxins of obstruction which are the result of putrefaction of the intestinal content pass more freely into the circulation, thus furnishing the lethal toxemia of obstruction.

Whether these toxins originate from micro-organisms or from the intestinal contents as maintained by Brooks *et al.*, whether they originate from faulty intestinal digestion or from intramucosal intestinal origin as maintained by Whipple *et al.*, or whether they are the result of dehydration, is immaterial except as the origin affects the ultimate production of a serum. It is evident clinically that the typical toxemia is not apparent when there is no paralytic dilatation of the gut; when the gut is contracted as a result of morphine administration the toxemia of paralytic obstruction does not occur. In local peritonitis, when the gut is contracted and its vascular supply is lowered, there is but one group of toxins to combat, i.e., those coming from the peritonitis. Therefore, before operation and immediately after operation, it is of great assistance if one can be assured of a contracted gut. If this pre-operative and postoperative status has not been established, if there is present or there has developed a paralytic type of stasis of the gut with a toxemia of intra-intestinal origin as well as a toxemia of peritonitis, the outlook is grave.

In these difficult borderline cases in which the patient hovers between recovery and death, complications may often be foreseen and prevented if the physiological processes as affecting the patient in question are kept in mind. Observations as to the volume intake and output of fluids—bearing in mind the amount of excretion necessary to eliminate a heavy toxemia—as to the conditions of renal excretion, as to the cardiovascular circulatory balance, as to respiratory conditions, as to blood chemistry and consultation when problems as to heart, blood, and respiration arise, will keep the clinician alert to changing conditions of the patient. Quick appreciation of the dry tongue and skin, the rapid pulse, the lessening of elimination, the distention, the restless discomfort, as well as many other indications to which the practicing physician, familiar with the physiological phase of medicine is aware, will often turn the trend to recovery.

OTHER CAUSES OF MORTALITY

During the years between 1910 and 1930, approximately, there developed in the surgical

world a certain indifference to the problems of appendicitis. Such problems as the treatment of surgical shock, surgery of the thyroid gland, the treatment of ulcer, war surgery—even the war itself—as well as research in these various lines, so fully occupied the surgical mind that a disease so well understood as appendicitis received little attention. Appendectomy was performed in the early training of the young surgeon and it was practiced by the general practitioner who, even with insufficient surgical training and insufficient surgical practice, did all the surgery which had to be done in his practice and which his ambition urged him he could do, often to the detriment of the patient. A certain lack of respect for the problems encountered in appendicitis developed. A patient with an appendix filled with pus was and is still referred to a member of the resident staff, and it is in the handling of such cases that he begins his experience with abdominal surgery. Familiarity breeds contempt. The writer has sometimes heard the remark by a visiting staff member: "Let so and so do it," the time being night or there being so called more serious engagements at hand. After many years of hospital, ward, and private practice, I am convinced that this unfortunate circumstance is no mean factor in causing deaths from appendicitis—the untrained young man develops a confidence and is willing to take a chance not justified by his experience. The training of hospital internes is another factor of importance to be considered. Toward the end of his first interne year, the young physician frequently wants to begin the active practice of surgery. He may be planning to enter into general practice and, of course, wrongly plans to do all the surgery he can. He may not be able, for various reasons, to spend the minimum 3 years which are considered by those of experience to be necessary to secure fair surgical training. Such conditions prevail more or less in all hospitals throughout the country, especially in those not connected with medical schools. Young internes who are thus permitted to perform operations for appendicitis, to repair hernia, etc., are in danger of acquiring a certain ungrounded confidence which, with their entirely insufficient surgical training, makes them dangerous factors for doing the surgical work in their general practice. Familiarity again breeds contempt; self-assurance and ambition become costly practice, and, indeed, have been important factors, during the past 30 years, in increasing the mortality percentages of appendicitis.

CONCLUSIONS

1. More serious consideration of the treatment of appendicitis should be given by the senior experienced surgeon.
2. Physiological principles should be strictly observed.
3. Patients having appendicitis with peritonitis should be assigned to none but the most thoroughly trained and experienced.
4. Immediate operation should be done when diagnosis is established.
5. The operation itself should be carefully done, should be non-traumatizing and non-shock producing, and every precaution should be taken to prevent the extension of infection.
6. Most rigid postoperative care should be carried out; nothing should be given by mouth; salines to physiological tolerance and morphine should be given; and the modified Fowler position should be used.

If these factors are kept in mind there can be but one result and that is a lowering of the prevailing mortality from appendicitis.

CLINICAL SURGERY

FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF MINNESOTA

HEMOSTASIS IN THYROIDECTOMY

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UNLIKE the surgical treatment of most structures, the surgical management of the thyroid gland is not concerned alone with a low mortality rate but because of its rich blood supply it is also seriously concerned with the problem of hemostasis. The operative mortality in thyroid surgery is accepted at the present time as less than 1 per cent. This low rate is obtained whether the surgeon proceeds without any plan, excising the gland as he would any other tumor and ligating the vessels as they bleed, or whether he follows a careful technique based on the anatomy involved. The thyroid surgeon, however, must obtain a good functional and cosmetic result as well as avoid technical complications, such as injuries to the laryngeal nerves, parathyroid bodies, and the occurrence of hemorrhage. A technique aimed mainly at hemostasis will best accomplish this end because injury to the laryngeal nerves and parathyroid bodies occurs probably most often in the attempt to apply ligatures to the thyroid arteries and in the attempt to control hemorrhage which occurs within the capsule.

The incision for thyroidectomy should be relatively straight and in patients with ordinary sized goiters it should be placed about one finger breadth above the upper border of the sternal ends of the clavicles (Fig. 1). In the patients with larger goiters, because of the resulting looseness of the skin, the incision should be relatively higher to prevent "dropping" of the scar onto the upper chest. The incision should go down to, and through the superficial layer of the deep cervical fascia thereby including the anterior jugular veins which are dissected back with the anterior flap. After the bleeding in the upper flap has been controlled, the lower margin of the wound is undermined for a distance of about 2 centimeters. This important procedure prevents an "overhanging" of the skin of the upper flap after operation. Inclusion of the superficial layer of the deep cervical fascia in the flap has the advantage of preventing ecchymosis of the skin in the thin patient and when the prethyroid muscles have been thus exposed without their fascial investments, they can readily be retracted without cutting (Fig. 2 A).

While ligation of the inferior thyroid artery may be accomplished within the thyroid space during or after the removal of the gland, we have followed the teaching of deQuervain and apply a ligature to the inferior thyroid artery before proceeding to an excision of the gland. The median border of the sternomastoid muscle is freed and drawn outward with a blunt retractor. The exposed fascia of the prethyroid muscle is now slit vertically for about 3 centimeters (Fig. 2 A). The outer edge of the slit fascia is pared back gently and the finger is gently slipped down through the areolar tissue mesial to the carotid sheath to the transverse processes of the vertebra. The inferior thyroid artery is readily felt at the level of the sixth cervical vertebra (usually marked by a small tubercle), as it emerges at right angles to the carotid sheath. Exposure is quickly accomplished by placing retractors into the depth, with the outer retractor including the sternomastoid muscle, the carotid artery, vagus nerve, and jugular vein and the mesial retractor holding the prethyroid muscles and the thyroid mass (Fig. 2 B and C and Fig. 3). The inferior thyroid artery is lifted from the prevertebral fascia with a blunt dissector and a linen suture is readily applied (Fig. 3), and at this stage of the operation the retractors removed.

In the ligation of the inferior thyroid artery, during or after the process of resection, the ligature is seldom applied to the trunk of the artery, but more often to one of its branches, thereby endangering the recurrent laryngeal nerve (Fig. 5) and naturally producing less hemostasis. Preliminary ligation of the inferior thyroid artery effects better hemostasis, which together with the more distant application of the ligature, offers greater safety to the recurrent laryngeal nerves and parathyroid bodies.

The retractors having been removed, the excision of the gland is begun through the median separation of the prethyroid muscles. Since the

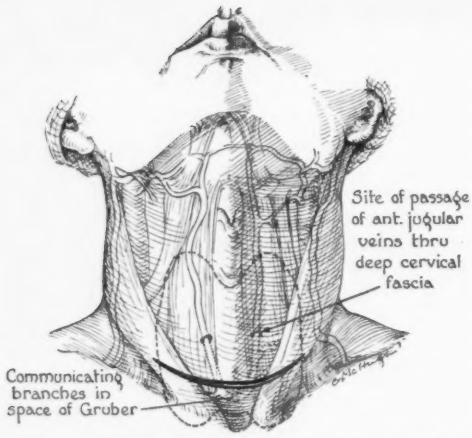

Fig. 1. Collar incision through skin and fascia of prethyroid muscles.

superficial layer of the deep cervical fascia has been dissected back with the anterior flap, it is possible to get sufficient exposure for excision of the smaller glands with the median separation of the prethyroid muscles. In the large glands, it is advisable not to stretch these muscles too far since they tear easily. In such cases, cutting of the muscles between clamps is best for good exposure. Before mobilizing the lobe it is well, after grasping it firmly with the tenaculum, to apply ligatures or clamps to the middle thyroid vein (Fig. 4 B), and cutting between. With this vein bisected, mobilization is more complete. The superior pole is next ligated by passing a carrier from within outward to include the pole *en masse* or the artery alone as desired. The ligature must pass around the whole pole and not through it (Fig. 4 A). A similar ligature is applied to the inferior thyroid veins immediately beneath the lower pole (Fig. 4 C). When this has been accomplished with both lobes, preliminary ligatures have been applied, as illustrated in Figure 5, to (1) the inferior thyroid arteries "extrafascially," (2) the superior thyroid arteries and veins, (3) the middle and (4) inferior thyroid veins. The gland can now be resected deliberately with very little bleeding.

Each lobe when resected is held firmly in the tenaculum and clamps are applied to the capsule (Fig. 6 A) to mark the cite of the incision before the removal of the gland. During the resection it is well to have the assistant hold a finger under the outer row of forceps. This assists in the control of bleeding and more thoroughly everts the entire lobe for a clean dissection. Interrupted sutures of plain catgut are used to close the stump (Fig. 6 B). When there is a large median lobe present, it is resected the same as a lateral lobe or included in the resection of one of the other lobes. After the capsule of both lobes has been

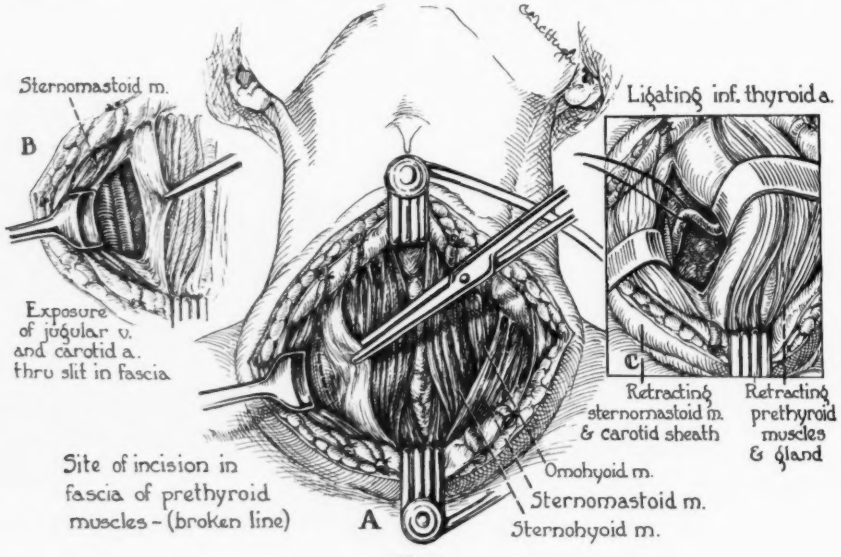
Sternomastoid m.
B
Exposure of jugular v. and carotid a. thru slit in fascia
Site of incision in fascia of prethyroid muscles - (broken line)
A
Ligating inf. thyroid a.
C
Retracting sternomastoid m. & carotid sheath
Retracting prethyroid muscles & gland
Omohyoid m.
Sternomastoid m.
Sternohyoid m.

Fig. 2

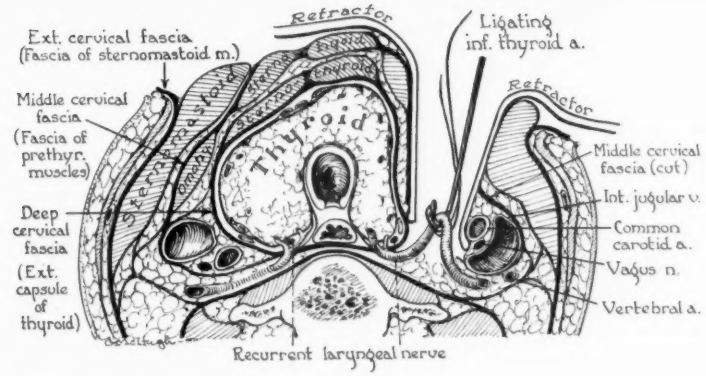

Fig. 3

sutured, the wound is held widely open and the patient is asked to strain. When the resection is done under gas anesthesia the patient is awakened sufficiently to cause automatic straining. This will expose any hidden bleeding which is cared for at once. Two "pants drains" (split tube) are placed down to the thyroid space through holes pierced in the fascia of the lower flap (Fig. 7 A) and the superficial layer of the deep cervical fascia is closed with interrupted plain catgut (Fig. 7 B). A running suture of fine plain catgut is placed in the platysma to approximate the skin margins, and the skin is closed with interrupted dermal suture and clips. For a good scar (a very important part of the operation) the clips, tubes, and dermal suture should be removed early.

Stage operations still have a place in the surgery of the thyroid in spite of the employment of iodine in the preparation of patients with hyperthyroidism. Ligation of the superior thyroid

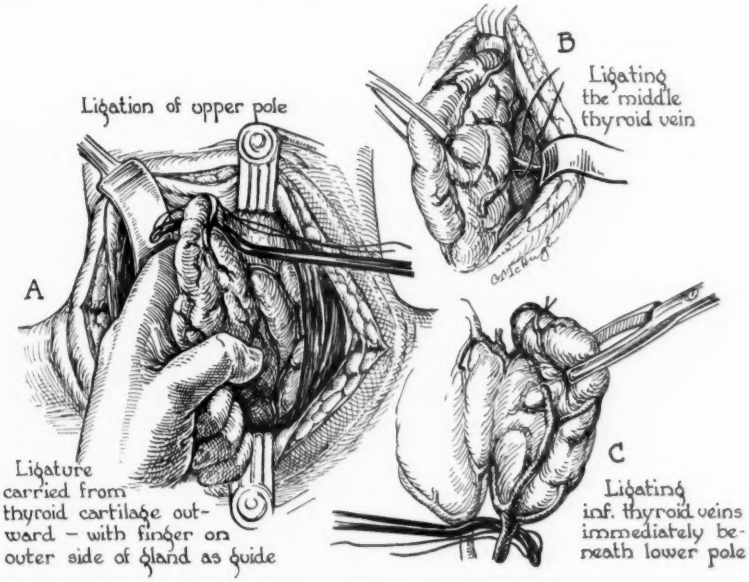
B
Ligating the middle thyroid vein
Ligation of upper pole
A
Ligature carried from thyroid cartilage outward – with finger on outer side of gland as guide
C
Ligating inf. thyroid veins immediately beneath lower pole

Fig. 4

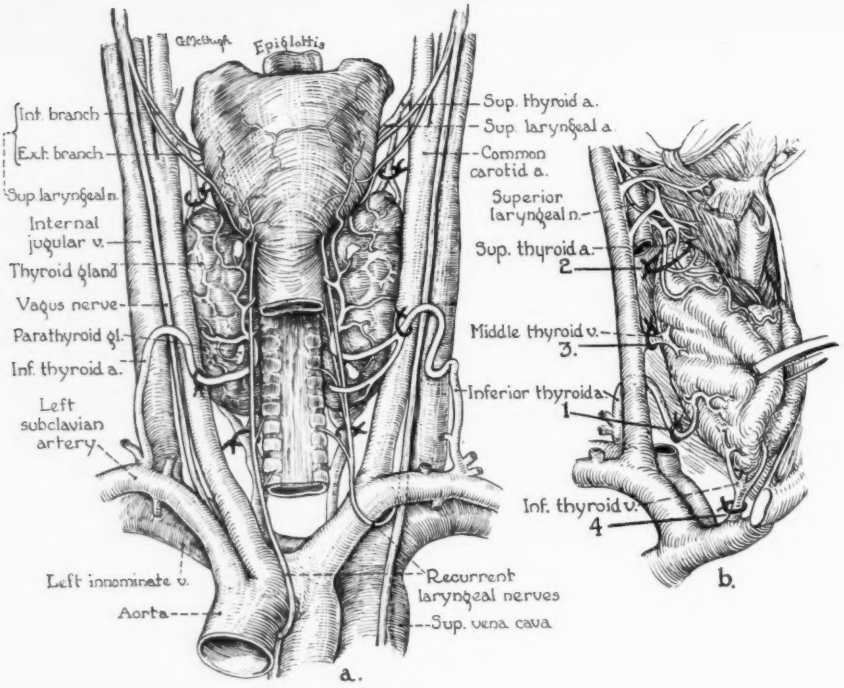

Fig. 5

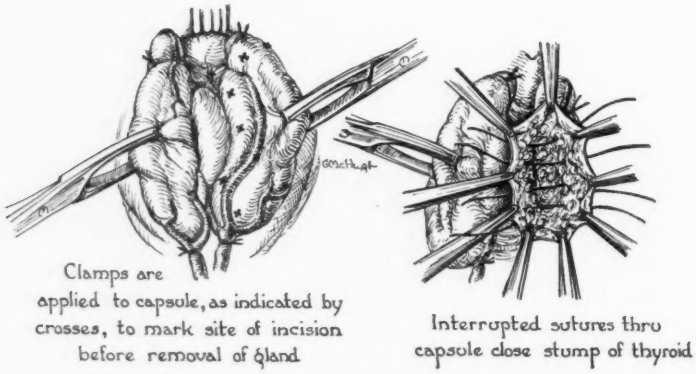
Clamps are applied to capsule, as indicated by crosses, to mark site of incision before removal of gland
Interrupted sutures thru capsule close stump of thyroid

Fig. 6

arteries is an excellent procedure in the cases which do not respond to the administration of Lugol's solution in the preparation for the later thyroidectomy. Speed is an essential factor in this operation. The incision is made in the skin crease opposite the cricoid cartilage beginning at the inner margin of the sternomastoid muscle and extending mesialward for about 4 centimeters (Fig. 8) and down through the superficial layer of the deep cervical fascia. The prethyroid muscles are retracted mesialward and the sternomastoid is pulled outward. With blunt dissection the

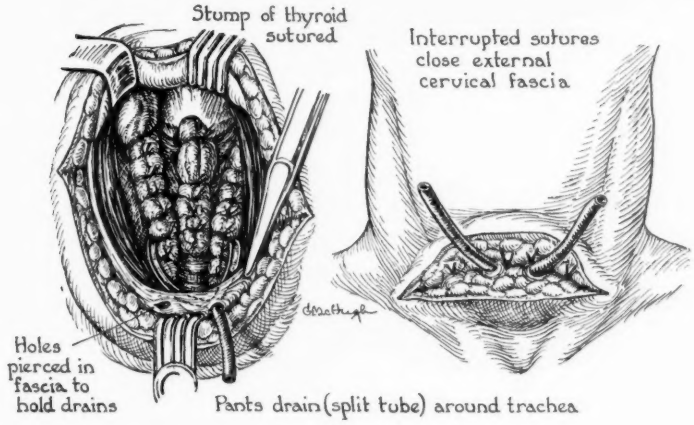
Stump of thyroid sutured
Interrupted sutures close external cervical fascia
Holes pierced in fascia to hold drains
Pants drain (split tube) around trachea

Fig. 7

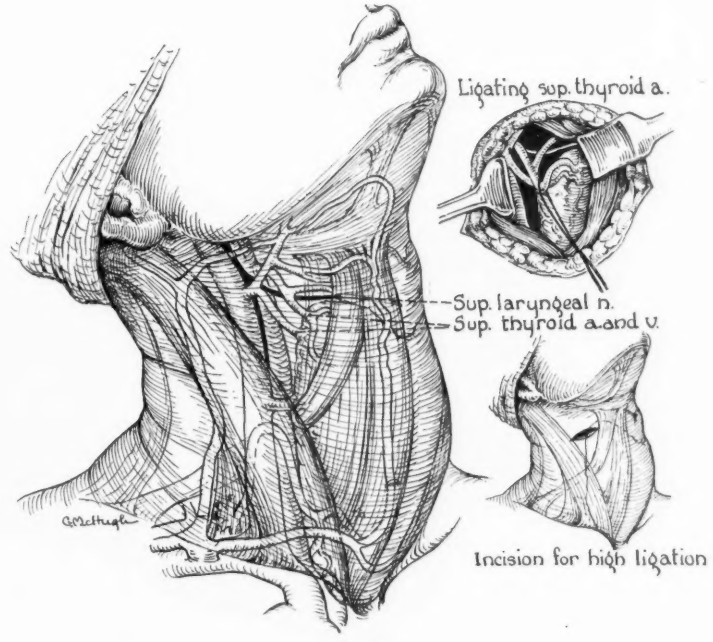

Fig. 8

upper pole of the thyroid is located. By following the pole upward as a guide we find the main trunk of the superior thyroid artery lying on the outer surface of the inferior constrictor of the pharynx. The superior laryngeal nerve is situated immediately above it. Caution must be exercised not to injure this nerve because of the resulting huskiness in the voice when this nerve is caught in the ligature. When bilateral superior pole ligation is planned it is well to remember that the left lobe is situated slightly lower than the right lobe.

SUMMARY

Surgery of the thyroid is very safe and technical complications can be avoided when the operator is adequately informed and takes proper precautions. Adequate knowledge of the anatomy involved and proper hemostasis make possible a neat, clean, practical operation, offering protection to the laryngeal nerves and parathyroid bodies. It has been shown by deQuervain, Mastin, Hertzler, Reinhoff, and others that the inferior thyroid artery is uniformly larger by one-third than the superior thyroid artery, in both normal and disturbed glands. It has further been demonstrated experimentally by Pettenkofer, and by Enderlin and Hotz that the blood supply of the parathyroids is not interfered with even after the ligature of all four thyroid arteries at their points of origin.

Proper hemostasis prevents postoperative hemorrhage and makes less drainage, more rapid convalescence, a better scar, and a greater chance of a permanent cure.

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THE TREATMENT OF ACUTE CHOLECYSTIC DISEASE

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A GREAT deal has been written in recent years in connection with acute cholecystic disease and the policies of immediate or delayed surgical intervention. If one were to take his conclusions from the literature alone he would be almost forced to conclude that there has been in the past few years a definite trend the nation over to resort to earlier and more radical surgery in these cases (10, 12, 14, 15, 16, 20, 22, 28). Several excellent historical reviews of this controversy have appeared in the literature in the past (5, 18, 28), and this phase of the subject need not be recapitulated at this time. Furthermore, no attempt will be made here to summarize the vast amount of material that has been published on the subject in the last few years. Inasmuch as most of the recent articles have been pleas for earlier operation, this trend may be more apparent than real, and we must not lose sight of the fact that many of the leading clinics throughout the country are still adhering to the more orthodox view of conservative therapy, reserving surgery for the interval after the acute symptoms have subsided.

Since this clinic has not adhered strictly to either of these policies of treatment our records show about an equal number of patients treated each way. The purpose of this communication is to present a study of the cases in which patients were treated surgically in this clinic during the past 10 years, with a critical analysis of the results obtained.

At the outset a word should be said in regard to the term "acute cholecystitis." In reading the recent literature one is struck by the probability that the various authors have different concepts as to which cases should justly fall into this classification. Considered from the standpoint of duration of symptoms, the term "acute cholecystitis" would include only cases in which patients are seen soon after the onset of the disease. Actually, we see few such patients in a clinic of this type where the patients are brought in from all over the state. The patient infrequently arrives at the hospital before the second or third day of the disease and often it is much later. From a clinical and pathological standpoint, however, these cases are still cases of "acute cholecystitis."

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The majority of the patients in the following study were admitted with high fever, leucocytosis, agonizing pain, extreme tenderness and rigidity over the gall-bladder area, and other signs pointing to acute inflammation of the biliary tract. The gross pathological changes at the time of operation and the histology of the tissue removed were taken as the final criteria as to whether or not the case was included in the study. Do these patients do better with immediate surgery or should they be given a chance for the condition to subside on conservative management? In what percentage does the cholecystitis fail to subside when treated conservatively? Is there any method of predicting in which cases it will subside and in which it will not? If emergency surgery is decided upon, what procedure should be carried out? It was in an attempt to answer such questions as these that the following study was undertaken.

In the 10 year period from 1925 to 1935, there were 103 patients with acute cholecystic disease admitted to the surgical service of the University Hospitals who received operative treatment. Thirteen of these patients did not present acute symptoms at the time of their admission and are included in the study only because an acute condition of the gall bladder was found at the time of operation and was confirmed by histological examination. These 13 cases will not be discussed further but do serve to emphasize the fact brought out so often in the literature (18, 25, 28, 29) that there is frequently a lack of correlation between the clinical signs and symptoms and the pathological changes found at the time of operation. The 90 remaining cases serve as the basis of the present study. All these patients entered the hospital with more or less severe symptoms pointing to acute disease of the gall bladder.

Of the total 103 cases, there were 80 females and 23 males, females predominating in a ratio of 7 to 2. The ages varied from 17 to 75 years, the average being 48.4 years. Of significance is the fact that in 44 cases, or 42.7 per cent of the group, the patients were over 50 years of age.

Pain was by far the most common symptom, being present in 93 of the 103 patients, or 90 per cent. Of the physical signs, *tenderness* led the list and was present in 98 of the 103 cases, or 95 per cent. *Rigidity* was present in 78 cases, or 76 per cent. Thirty-eight patients, or 37 per cent of the

series, showed some degree of *jaundice;* 18, or 17 per cent, gave a history of *chills*. A *palpable mass* in the gall-bladder area was present in 35 cases, or 34 per cent; 11 more were described as having a questionable mass in this region. The admission *temperature* ranged from 98 to 105 degrees, the average being 100.4 degrees. The *leucocyte count* ranged from 6,600 to 47,400, the average being about 15,000. The various symptoms will be taken up again later in correlation with the pathological changes found.

The 90 acute cases were first divided into groups depending upon the duration of symptoms prior to operation. In this manner the following classification was derived:

		Cases
Group I.	Operated upon within 48 hours of onset of symptoms	6
Group II.	48–72 hours, inclusive	6
Group III.	72–96 hours, inclusive	4
Group IV.	96–120 hours, inclusive	6
Group V.	120 hours to 7 days, inclusive	19
Group VI.	8 to 10 days, inclusive	17
Group VII.	Over 10 days	32

Table I shows the clinical data, operative findings, pathology, and bacteriology of the series when classified in this manner.

It will be seen that from a clinical standpoint there was no great difference in the symptoms or signs in the various groups. The chief exception to this observation was the higher percentage of palpable masses present in patients operated upon after 4 days had elapsed.

There was a tendency to perform only cholecystostomy in the early cases, while the percentage of cholecystectomies increased steadily as the time element became more prolonged.

In analyzing the pathological changes found, we see that even in the early groups there was a great variety. In the group of patients operated upon under 48 hours there was one patient with a gall bladder already gangrenous. There were 2 cases in which perforation had occurred—one had a generalized peritonitis and the other a well localized pericholecystic abscess. Of the various pathological conditions, empyema was found most frequently throughout the entire series, with pericholecystic abscess in second place. Of the total of 90 cases, in only 9 had the condition subsided sufficiently by the time of operation to warrant a histological diagnosis of subacute or chronic cholecystitis, and in none of these cases was the condition found under 8 days.

In 40 per cent of the cultures taken there was no growth, and the percentage of sterile cultures tended to be higher in the groups of patients operated upon late in the illness. The predominating organism found in the patients operated upon earlier was Escherichia coli.

Although Table I brings out many interesting features in regard to acute disease of the gall bladder, it offers very little help in the matter of treatment. There were five mortalities in the series (5.6 per cent) but many of the individual groups are so small that the percentages probably do not justify the formation of conclusions. *Certainly, no one group or time period was outstanding as the optimum time for operation.* Consequently, we were still faced with the problem of evaluating the two main policies of treatment—immediate vs. delayed operation.

The cases were, therefore, re-divided into two main groups depending upon which policy of treatment was pursued. An arbitrary time limit of 24 hours following admission of the patient was chosen to separate the cases into an "immediate" and a "delayed" group. There were 41 patients in the former group[1] and 49 patients in the latter. In the group having "immediate" operation the time interval between admission and operation varied between 1 and 24 hours, the average delay being 11.5 hours.

In the group having "delayed" operation conservative measures were instituted for more than 24 hours after admission in the hope that the process would subside. This conservative regimen, although not as rigid as some authors recommend (3), consisted chiefly in repeated hypodermics of morphine, an ice bag to the gall-bladder area, intravenous infusions of 5 or 10 per cent glucose, and limitation of the diet to fluids only. On this regimen there were 15 patients of the 49 so treated in whom the disease failed to subside clinically and who were eventually operated upon in an acute phase of the disease. Two more cases subsided but the symptoms promptly recurred and emergency operation was considered necessary. This makes a total of 17 cases, or 35 per cent of the group, in which conservative measures failed to bring about the desired result. The other 65 per cent responded to the conservative therapy and the patients were operated upon during the interval. One patient was allowed to go home and return for the operation; the others were kept in the hospital under observation during this period of treatment. The average lapse of time between admission and operation was 7.6 days.

[1]Six patients in this group were operated upon immediately because the pre-operative diagnosis wavered between acute cholecystitis and acute appendicitis. Had the correct diagnosis been known, it is possible that they would have been treated conservatively and the condition given a chance to subside.

TABLE I.—ANALYSIS OF CASES

Data	Under 48 hrs.		48–72 hours		72–96 hours		96–120 hours		120 hrs. 7 days		8–10 days		Over 10 days		Total	
Number of cases	6		6		4		6		19		17		32		90	
Average age	48		55		46		52		42		45		48		47	
Average temperature	100.5		100.6		99.9		102.6		100.6		100.5		100.5		100.6	
Average leucocyte count	16,500		20,300		20,100		17,700		15,800		14,600		17,400		16,800	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No	Per cent	No.	Per cent	No.	Per cent
Palpable mass	1	17	1	17			6	100	9	47	9	50	15	47	41	46
Operative procedure:																
Cholecystostomy	5	83	6	100	3	75	6	100	13	69	9	54	10	31	52	58
Cholecystectomy					1	25			4	21	5	29	14	44	24	27
Cholecystostomy plus choledochostomy	1	17											1	3	2	2
Cholecystectomy plus choledochostomy											1	6	6	19	7	8
Choledochostomy only									1	5					1	1
Simple drainage									1	5	2	11	1	3	4	4
Pathological changes:																
Subacute or chronic											4	23	5	16	9	10
Simple acute	1	17	1	17	1	25	1	17	2	11	2	12	4	12	12	13
Hydrops	1	17							3	16	2	12	2	6	8	9
Empyema	1	17	4	66	2	50	3	50	10	52	5	29	12	38	37	41
Gangrene	1	17	1	17			2	33	1	5					5	6
Perforation—abscess	1	17							2	11	3	18	9	28	15	17
Perforation—generalized peritonitis	1	17			1	25			1	5	1	6			4	4
Stones present	6	100	5	83	4	100	6	100	16	89	16	94	30	94	83	92
Bacteriology:																
Cultures taken	3		6		4		6		14		12		23		68	
Sterile	2	66	2	33	1	25	2	33	4	29	8	68	8	35	27	40
Escherichia coli			3	50	2	50	3	50	8	57	1	8	7	30	24	35
Streptococcus viridans					1	25					1	8	6	27	8	12
No known pathogen							1	17	1	7	1	8	1	4	4	6
Miscellaneous	1	33	1	17					1	7	1	8	1	4	5	7
Postoperative course:																
Smooth	5	83	4	66	2	50	3	50	13	68	13	76	21	66	61	68
Fair	1	17					2	33	3	16	1	6	4	12	11	12
Stormy			2	33	2	50	1	17	3	16	3	18	7	22	18	20
Hospital days	21		22		35		27		26		27		31		28	
Mortality			1	17							1	6	3	9.4	5	5.6

By dividing the cases in the above manner we have two groups in which operation was performed during an acute phase of the disease—one relatively early, the other late; and a third group in which operation was performed in the interval after the acute manifestations had subsided.

The statistical data of each of these three main groups is combined in Table II for comparative study.

Let us now analyze each group more carefully in an effort to evaluate the results of early and delayed operation.

PATHOLOGICAL CHANGES FOUND

Taking up first the 41 cases in which the patients had immediate operation—how many of them had irreversible pathological changes at the time of operation? There is, of course, some difference of opinion as to what should be classified as "irreversible pathological changes." Some authors would include only cases of gangrene and perforation, while others would include the more virulent cases of empyema and simple acute cholecystitis. It is usually impossible to tell at the time of operation whether the inflammatory process is advancing or subsiding, but there would seem to be ample clinical evidence to the effect that the conditions of empyema, hydrops, and simple acute cholecystitis do subside spontaneously as far as clinical signs and symptoms are concerned. Perforation of the gall bladder with pericholecystic abscess is also known to undergo retrogressive changes in which the abscess becomes better walled off and more chronic in nature, with disappearance of clinical manifestations of disease. Thus, the term "irreversible pathology" does not necessarily mean that the disease process is a progressively fatal one. Including only the cases of gangrene and actual perforation, we have 11 cases, or 27 per cent of the group, in which in a

strict pathological sense there were irreversible changes in the gall-bladder wall. It is altogether possible that, had not immediate operation been resorted to, in a certain percentage of the 18 cases of empyema the condition would also have gone on to gangrene and perforation.

In the group of patients treated by delayed operation we have already seen that in 18, or 35 per cent of the group, the condition failed to subside clinically to the extent that conservative therapy was abandoned and emergency operation performed. In this group we find a high percentage of cases with so called irreversible pathological changes, namely, gangrene or perforation with abscess formation (41 per cent). It seems logical to assume, therefore, that the 27 per cent of cases in the first group would also have failed to respond to conservative therapy. In the face of these facts it would appear that about every third patient with acute cholecystitis who has been admitted to this clinic has presented such extensive pathological changes that a subsidence of the clinical symptoms by conservative measures was not possible. It is also of interest to note that of the 49 cases in the delayed group, only 9 patients, or 18 per cent, had subsided sufficiently by the time of operation to warrant a pathological diagnosis of subacute or chronic cholecystitis. This emphasizes the point stressed in the literature that it is often impossible to predict the extent of the pathological process from the clinical findings (18, 25, 28, 29, 30). Of the 32 cases in which a satisfactory subsidence of clinical signs was obtained, operation revealed 12 with empyemas and 6 with pericholecystic abscess.

It has been the dictum of the past to place perforation of the gall bladder among the rarities of surgical practice. However, in recent years, much has been written to the effect that this complication is much more common than was formerly believed (11, 13, 16, 19, 25, 30). Our experience corroborates this latter belief. Of the total 103 cases reviewed in this series there were 23 with perforations, or 22 per cent of the series. In the greater portion of these there was sufficient walling off to form a pericholecystic abscess. However, there were 4 cases with perforation into the free peritoneal cavity and a generalized peritonitis (3.9 per cent). Thus, we see that the experience of this clinic with perforation of the gall bladder has been rather extensive, and about every fourth patient with acute cholecystitis admitted to the clinic has shown this advanced pathological change.

BACTERIOLOGY

Considerable work has been done on the bacteriological aspect of acute cholecystic disease and a number of writers have emphasized the point that cultures of the pus from the empyema are often sterile (12, 20). Andrews, in a recent article, expresses doubt as to the existence of true empyemas; he feels that in most cases of so called empyema the "pus" is simply precipitated calcium or cholesterol.

In our series of cases the bacteriological findings correspond fairly well with those reported in the literature. Cultures were reported as sterile in about 40 per cent of the cases in which they were taken. Escherichia coli was the organism most commonly cultured, with Streptococcus viridans in second place. No cultures of Bacillus typhosus were obtained. We are inclined to agree with Andrews in his belief that in many instances the underlying lesion in acute cholecystic disease is vascular rather than infectious in nature and may be likened to a hemorrhagic infarct of the gall bladder wall. Impaction of a stone in the cystic duct is a very common finding in acute disease of the gall bladder and is undoubtedly a most important etiological agent.

Referring to Table II, we see that in the patients operated upon early there were sterile cultures in 39 per cent, while in those cases in which the condition was allowed to subside cultures were sterile in 57 per cent, an increase of 18 per cent. It is interesting to speculate on the significance of this finding. Possibly the period of conservative treatment was instrumental in allowing the infection to "burn itself out." It has been suggested that the bile may be a factor in reducing the virulence of the organisms. On the other hand, it may be argued that the factor responsible for subsidence in these cases was a higher percentage of sterile cultures from the beginning. In favor of this view is the fact that in the group in which the condition failed to subside on conservative treatment there was the lowest number of sterile cultures obtained (20 per cent).

The incidence of gall stones in this series of cases is striking, there being only 8 cases in the total number reviewed in which no stones were found. The incidence of stones was, therefore, about 92 per cent. Common duct stones were found in about 7 per cent of the series.

MORTALITY

The mortality figure for the entire group of cases was 5.6 per cent, a figure which corresponds favorably with other statistics in the literature (1, 16, 21, 23, 27, 30).

In the group having immediate surgery there were 3 deaths, giving a mortality of 7.3 per cent for the group.

TABLE II

Data	Group having early operation— Operated upon during an acute phase of the disease		Group having delayed operation			
			Symptoms subsided. Operated upon in interval		Symptoms failed to subside. Operated upon during an acute phase	
Number of cases	41		32		17	
Average age	44		45		54	
Average temperature on admission	100.6		99.8		101	
Average leucocyte count on admission	17,000		15,600		15,100	
Average delay from admission to operation	11.5 hours		7.6 days		5.1 days	
	No.	Per cent	No.	Per cent	No.	Per cent
Pathological changes:						
Chronic or subacute cholecystitis			9	28		
Simple acute cholecystitis	9	22	1	3	2	12
Hydrops of gall bladder	3	7	4	13	1	6
Empyema of gall bladder	18	44	12	38	7	41
Gangrene, not perforated	4	10			1	6
Perforation with abscess	3	7	6	18	6	35
Perforation with general peritonitis	4	10				
Stones present	37	90	30	94	16	94
Type of operative procedure:						
Cholecystectomy	4	10	17	53	3	17
Cholecystostomy	32	78	10	31	10	59
Cholecystectomy, choledochostomy	2	5	4	13	1	6
Cholecystostomy, choledochostomy	2	5				
Choledochostomy alone					1	6
Simple drainage of an abscess	1	2	1	3	2	12
Bacteriology:						
Cultures taken	32		21		15	
Sterile	12	38	12	57	3	20
Escherichia coli	13	41	2	28	7	47
Streptococcus viridans	3	9	3	15	2	13
No known pathogen	3	9			1	7
Miscellaneous	1	3			2	13
Mortality	3	7.3			2	12
Postoperative course:						
Smooth		68		82		61
Notable complications		32		18		39
Average hospital days:						
Total	27		28		32	
Postoperative	26		20		27	

One 74 year old man was moribund on admission but was operated upon and a gangrenous gall bladder with a generalized peritonitis was found. Cholecystostomy was carried out. Cultures grew Escherichia coli and Streptococcus viridans. His postoperative course was stormy and he died 7 days later of bronchopneumonia. Autopsy confirmed this diagnosis.

The second case was a woman 84 years old who had a simple acute cholecystitis complicated by common duct stones. The gall bladder was removed and the common duct was drained. She developed a blood stream infection with Streptococcus viridans and died on her thirtieth postoperative day. Autopsy showed a portal and mesenteric thrombophlebitis, suppurative pylephlebitis, liver abscesses, and a subphrenic abscess.

The third case was a woman 71 years old, who had an empyema of the gall bladder for which a cholecystostomy was performed. Cultures grew Escherichia coli. She died shortly after operation, presumably from shock. No autopsy was obtained.

In the group in which the symptoms subsided and operation was performed in the interval, there were no deaths. In the group in which the symptoms failed to subside on conservative treatment, there were 2 deaths, or a mortality of 12 per cent.

One patient, woman, aged 75 years, was operated upon as an emergency 9 days after admission. An acute condition of the gall bladder was found, complicated by common duct stones and evidence of an acute cholangeitis. Cholecystectomy and choledochostomy were performed and cultures of the bile grew Escherichia coli. After operation she developed a pulmonary edema with cough which brought about a wound separation and evisceration. Peritonitis followed and this was the cause of her death. No autopsy was obtained.

The other case was that of a 66 year old woman who was operated upon as an emergency after 3 days of conservative treatment. A perforated gall bladder with multiple pericholecystic abscesses was found and cholecystostomy was performed. Cultures grew Escherichia coli and Streptococcus viridans. She had a long and stormy course with a severe wound infection and a duodenal fistula. Eventually the evidence of a subphrenic abscess presented itself and this was drained transpleurally in two stages. She died shortly after the second stage, presumably of a pneumonia. No autopsy was obtained.

It is of interest to note that Streptococcus viridans was cultured in 3 of the 5 fatal cases. One also may observe that there is a tendency for the mortality figure to rise steadily as the pathological process increases in severity.

A glance at Table II shows no mortalities among the cases in which the symptoms were allowed to subside and the patients were operated upon in the interval. However, in the group in which symptoms failed to subside on conservative treatment, the mortality reached its highest peak (12 per cent). Although the series is small it would seem that this figure may be of significance.

If we analyze the mortality figures according to the type of operative procedure carried out, we find that 3 deaths followed cholecystostomy and 2 followed cholecystectomy plus choledochostomy. It must be remembered, however, that cholecystostomy was the operation of choice on the poorer risks and on the patients presenting the most marked pathological changes. The presence of common duct stones, necessitating the opening of the common duct naturally increases the mortality in these elderly patients.

There was nothing unusual in the clinical history or physical examination of the fatal cases that labeled these cases as more serious than the average, and the temperature reaction and leucocyte count were not out of proportion. However, the average age of patients in the fatal groups was 71 years as compared with 46.4 years for the entire group. The average duration of symptoms before admission was 15 days or nearly twice as long as the average for the entire group. These two factors were probably important from the standpoint of mortality.

MORBIDITY

Referring again to Table II, we see that the average number of postoperative days was slightly more for the patients operated upon during an acute phase of the disease. This is explained by the fact that in these cases cholecystostomy was done more often rather than cholecystectomy. The average number of postoperative days for patients receiving cholecystostomy was 26 days as compared with 17 days for those on whom a cholecystectomy was done. In other words, the patient receiving a cholecystostomy must expect to remain in the hospital an average of 9 days longer than the patient who has the gall bladder removed. Furthermore, we find that wound infections and stormy postoperative courses appear more frequently in the cholecystostomy group. In evaluating the morbidity we should perhaps realize again that cholecystostomy has been the procedure carried out on the more desperately ill patients, and this factor may easily account for some of the apparent differences.

LATE RESULTS OF CHOLECYSTOSTOMY

The late results of cholecystostomy vary markedly in different clinics (4, 8, 9, 17). Most writers report a high incidence of recurrence of symptoms, cholecystectomy eventually being necessary (6, 7, 24, 26). In this series of cases a follow-up report was obtained in 42 cases in which a cholecystostomy had been done for acute cholecystitis, the longest time interval since operation being about 7 years. Of these, in 80 per cent there was complete relief of symptoms immediately following the procedure, but in only 40 per cent was the relief permanent. The other 40 per cent had a recurrence of symptoms in from 1 month to 3 years following operation. There were 9 patients, or 20 per cent, who did not get even temporary relief. Seven patients, or 17 per cent of the group followed, came to re-operation. Two of these patients were re-operated upon while they were still in the hospital, cholecystectomy being carried out. A third patient returned in 1 month with a biliary fistula still present and a cholecystectomy was done at that time. A fourth returned for cholecystectomy in 3 months. The 3 other cholecystectomies were done 1 year, 2 years, and 4 years, respectively, after the first operation. It is possible that, if 10 years hence the group were followed again, the percentage of permanent relief from cholecystostomy would be even lower than 40 per cent (24).

The average duration of bile drainage following cholecystostomy was about 5 weeks, the extremes being 2 weeks and 3 months. This does not include 2 cases of apparently permanent biliary fistula which have been draining bile for 1 year and 3 years, respectively. The incidence of incisional hernia in the followed cases of cholecystostomy was 19 per cent. In the light of the figures given it would seem advisable to carry out cholecystectomy whenever at all feasible.

TREATMENT

As has been brought out, there were about an equal number of patients in this series who were operated upon immediately (41 cases) and treated conservatively (49 cases). The series should, for this reason, be very well suited for a critical analysis of the merits of each form of treatment. It should be emphasized again that, in the strict sense of the word, very few of the patients were operated upon in the earliest stages of the disease

(Table I). Since we seldom see very early cases in this clinic, our problem has been in respect to the treatment of the patients as we see them, several days having elapsed since the onset of their symptoms. In the patients operated upon within the first 24 hours after admission, the mortality was 7.3 per cent—a figure somewhat higher than the mortality for the entire group of cases. In the cases in which the symptoms were allowed to subside and the patients were operated upon during the interval there was no mortality. It would appear, therefore, that *if in each case the symptoms could be depended upon to subside, then the conservative form of therapy would be without question the most judicious.*

However, we are faced with the fact that of the 49 patients who were treated conservatively there were 17, or 35 per cent, who failed to subside and were by necessity subjected to operation in an acute stage of the disease. It is this group that carried the high mortality, the high morbidity, the greatest number of complications, and the greatest number of hospital days.

For this reason a careful analysis was made of this group in an effort to find some constant factor which might enable us to tell in advance in which cases it was possible the symptoms would subside on conservative management and in which they would not. A glance at the clinical symptoms is at once discouraging in this respect. *Pain, tenderness,* and *rigidity* are such constant findings that no help is offered along this line. *Jaundice* was seen more often in patients with perforation or gangrene than in any other single pathological condition. It was present in approximately half the patients who were later found to have a perforation. This is of very little diagnostic help, however, since it also occurs in simple acute cholecystitis, empyema, and of course in those cases in which a stone is present in the common duct. In our series it was seen eight times in empyema and nine times in simple acute cholecystitis. *Chills* similarly occurred with all types of the disease and were not always associated with common duct pathology. Chills associated with empyema occurred eight times and with simple acute cholecystitis and perforation of the gall bladder four times each. By far the majority of patients in whom a *palpable mass* was felt proved to have either an empyema or a hydrops of the gall bladder. However, a mass, or at least a questionable mass, was also felt in 7 cases with perforations and pericholecystic abscesses, and in 6 cases of simple acute cholecystitis. A study of the *temperature reactions* produced by the various types of cholecystic disease was also marked by disappointment; the group of cases showing the most marked pathological changes had only very slightly higher temperatures than the average of the entire series. There were 21 patients having fever over 102 degrees; 8 of these had empyema, 4 had simple acute cholecystitis, 4 had perforations, 3 had gangrene, and 2 had subacute cholecystitis. It soon becomes obvious that we cannot estimate the extent of the disease by the febrile reaction it produces.

Finally we turn to the *leucocyte count* for help. This laboratory test has been suggested by several authors as the most reliable indication of the severity of the inflammatory process (27, 30). There were 33 cases in this series having leucocyte counts over 15,000. Of these, approximately 50 per cent were in patients with empyemas. The other 50 per cent were about equally divided among the other groups. Although the highest counts were seen in cases of empyema there were enough low ones to bring the average of the entire empyema group down to 15,000. As a matter of fact, in 44 per cent of the empyema cases the leucocyte counts were below 15,000. The average leucocyte count of the cases in which symptoms failed to subside on conservative therapy was 15,100; the average leucocyte count of the group of fatal cases was only 16,600.

Thus we are forced to admit, as so many have done in the literature, that we are often quite helpless in predicting the extent of the pathological process until the abdomen has been opened at the time of operation. In the cases in which symptoms failed to subside on conservative management, we find a high percentage of stones impacted in the cystic duct (89 per cent) and a higher percentage of perforations (35 per cent). There was also a higher percentage of positive cultures obtained in this group. The patients in this group were 4 to 5 years older than the average of the entire series, and the delay in coming to the hospital was 1 to 3 days more—factors which may be of some significance. However, there was nothing in the symptomatology or physical signs on admission that would lead one to suspect a more active or progressive type of infection. We must, therefore, face the facts and state once more that we cannot with any degree of certainty tell in advance in which cases symptoms will subside on conservative management and in which they will not. An increase in the amount of pain, tenderness, or rigidity; a rising temperature; or a rising leucocyte count should certainly be indications to discontinue conservative therapy in favor of operation.

Indeed, it would appear that there are entirely too many factors at work in the course of acute

cholecystic disease to afford much hope for the standardization of its treatment. Until we have learned the reason why in some cases the disease progresses and in others subsides, the best form of therapy would seem to be one of individualization. For those who are experts in the surgical treatment of the biliary tract, the hazards of operation during the stage of acute inflammation are, of course, not so great. However, the practice of early operation in an indiscriminant fashion by the general run of surgeons would probably bring about an increase in the mortality throughout the country. In each case there is an optimum time for operation and the determination of which must be based on a study of the individual problem.

A discussion of acute cholecystic disease is not complete without due emphasis in regard to the prophylactic treatment. Practically all writers on this subject bring out the fact that a high percentage of cases give histories of gall-bladder disease in the past (15). In our series of cases, gall stones were present in 92 per cent. There were 13 patients in the entire group in whom the attack bringing them to the hospital was the first manifestation of cholecystic disease. The remaining 87 per cent gave a history suggesting biliary tract disease and about half of them had experienced definite biliary colic.

SUMMARY

1. The treatment of acute cholecystic disease has produced a great deal of controversy in the literature and general agreement is still lacking. There can be observed in recent publications a definite tendency to resort to surgery earlier in preference to the policy of conservative therapy, reserving operation until the interval.

2. Another series of surgically treated cases of acute cholecystitis is added to the literature for the statistical value which it may afford.

3. An analysis of the series in respect to the duration of symptoms before operation was of little value in establishing an optimum time for surgical intervention.

4. The fact that, of the 90 typical cases in this series, 41 were treated by immediate surgery and 49 were treated conservatively, makes the series of special value in analyzing the relative merits of these two policies of treatment.

5. Each group has been analyzed from all aspects of the disease. From the standpoint of both mortality and morbidity, the best results were obtained in cases in which symptoms were allowed to subside on conservative management and the patients were operated upon in the interval. However, of the total group treated by conservative measures, there were 32 per cent in which symptoms failed to subside and the patients were of necessity subjected to emergency surgery in an acute phase of the disease. These patients showed an even higher mortality and a greater morbidity than the patients who were operated upon as emergencies on admission.

6. No criterion was found by which it was possible to tell in advance with any certainty in which cases symptoms would subside and in which they would not.

7. The incidence of gangrene and perforation of the gall bladder was much higher than the teaching of the past has indicated; in nearly a fourth of the cases in this series this complication is shown.

8. The results of cholecystostomy are discussed, based on a follow-up of 42 patients so treated.

9. The problem of acute cholecystic disease is probably too complicated to be handled by any certain stereotyped policy of treatment. It would appear that this is a disease par excellence to be treated by individualizing each case as to the optimum time for operation.

Note.—I am greatly indebted to the late Dr. Howard L. Beye, my recent "chief" and counsellor, for his many helpful criticisms and his mature judgment in the analysis of the data obtained in this study.

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A SIMPLE AND EFFECTIVE METHOD FOR THE CLOSURE OF BILIARY FISTULAS

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PERSISTENT fistulous openings following drainage of the gall bladder usually discharge clear mucus, if a mucocele or hydrops of the gall bladder is present, or mucopurulent material, if due to a gall stone impacted in the neck of the gall bladder or cystic duct, or to a carcinoma. If the mucocele is a result of stenosis of the outlet, the gall bladder should be removed or the lining mucosa completely destroyed. A stone impacted in the neck of the gall bladder often may be removed without hospitalization of the patient. The fistulous tract is first enlarged by daily insertion of rubber tubes of increasing caliber, or by firm gauze packing, until a channel of sufficient size is formed to the point of obstruction. The calculus may then be detected with a probe or seen through a Kelly cystoscope or a urethroscope, dislodged by scoop or forceps, and removed. At times it is necessary to incise cautiously, or partially to destroy dense scar tissue overlying the stone. The latter may be accomplished by the application of small cotton swabs lightly moistened with a 10 per cent solution of chloride of zinc. If this powerful erosive is used, little should be applied and attempts to remove the stone delayed for 24 to 48 hours, during which time a firm dry gauze packing is left in place. To reduce the size of the exposed impacted stone, cotton swabs wet with ether may repeatedly be applied until sufficient cholesterin has been dissolved from the stone to enable its fragmentation, dislodgement, and extraction. With all obstruction removed the fistulous tract usually closes permanently within a few days. It is to be remembered that an acute or subacute purulent cholecystitis with gall stones is not uncommon in an unsuspected cancerous gall bladder. Twice after the calculi had been removed and the mucopurulent fistula closed, have we seen a cancer later develop in the abdominal scar.

Persistent partial leakage of the bile after cholecystectomy or the withdrawal of a drain from the cystic ducts usually indicates some type of obstruction in the ducts. In such a case we fit a rubber tube snugly in the fistulous channel and connect it with a Wagensteen or Pratt aspirator. Usually within 24 or 48 hours the flow of bile ceases when the tube is removed and the opening is permitted to close.

Fistulas following cholecystectomy or operation upon the biliary ducts from which all bile is discharged are much more troublesome and serious. From the constant loss of liquid, electrolytes and the impaired intestinal absorption, the patient tends to develop an increasing cachexia with impaired ability to withstand a serious operation. Usually the fistula has resulted from an accidental division to the common duct during a cholecystectomy or the common duct may have been drained but a more distal obstruction to the flow of bile has not been removed. Occasionally the fistula follows a cholecystostomy and is due to an obstruction of the common duct.

Irrespective of cause and at times despite the retention of average weight, the patient may be a poor subject for any prolonged intra-abdominal operation. To attempt to anastomose a divided duct or to unite the proximal end of an obstructed duct with the duodenum or stomach is a hazardous procedure. It is simpler to mobilize the abdominal fistula and to turn it into the adjacent duodenum or stomach, but the liberation of the fistulous tract is not always easy and the tract,

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Fig. 1. Line of excision of old scar after delineating fistulous tract by the injection of ethereal solution of methylene blue.

Fig. 2. The scar and subcutaneous fascia have been removed, thus exposing the sheath of the right rectus muscle with the fistulous opening. Parallel incisions have been made through the muscle on either side of the fistulous tract. Through the medial incision the duodenum has been withdrawn and sutured to the anterior sheath of the rectus. After completion of this suture line the margins of incision in the duodenum are to be sutured about the fistulous opening.

Fig. 3. The withdrawn duodenum is further sutured over the anterior sheath of the rectus by completing the outer row of encircling suture.

Fig. 4. The top sketch illustrates the withdrawn duodenum (or stomach) united to the split rectus muscle over the fistulous channel. In the middle sketch the segment of rectus muscle is so rotated that the attached portion of duodenum (or stomach) has been returned to the peritoneal cavity. In the bottom sketch the margins of the anterior and posterior sheaths of the unused part of the rectus muscle have been united by suture.

Fig. 5. Closure of the anterior rectus sheath over the rotated and depressed segment of rectus.

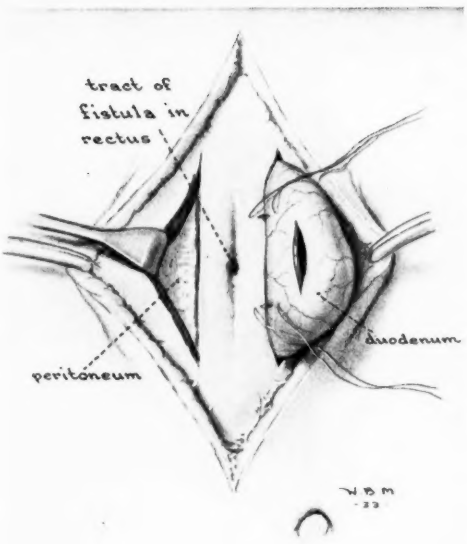

Fig. 2.

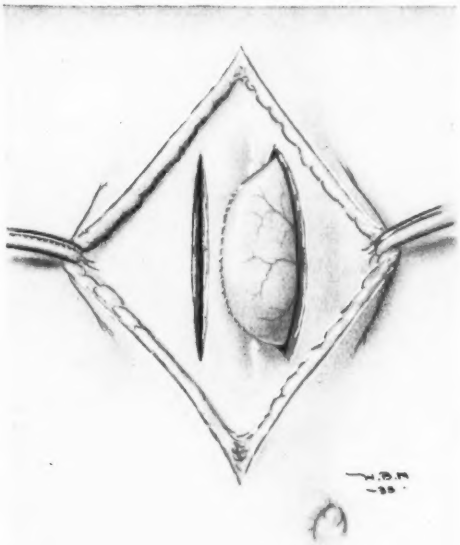

Fig. 3.

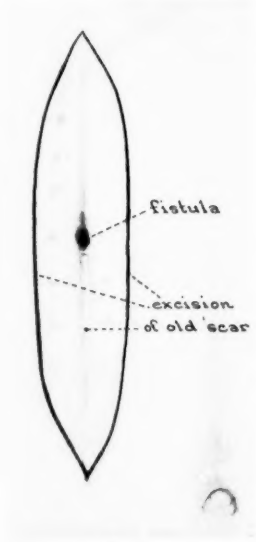

Fig. 1.

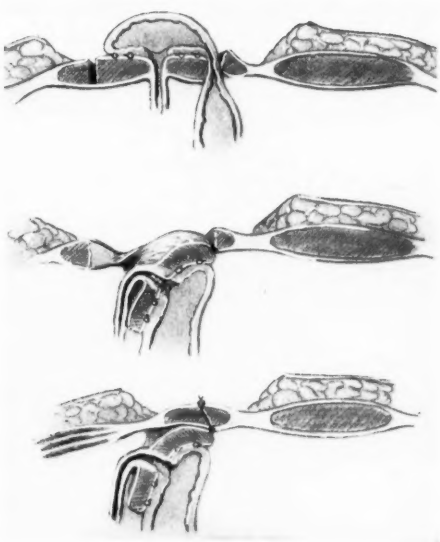

Fig. 4.

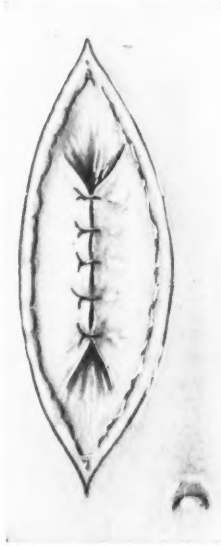

Fig. 5.

(Legends on opposite page.)

when separated from its source of blood supply, may necrose and the anastomosis may fail.

The following method which we have used for several years has been found to be an effective and relatively superficial operation which at times may be performed even without opening the free peritoneal cavity. It is important that the operation be delayed for 2 or 3 months, or until the fistulous tract has become well organized and established. During this time the escaping bile may be collected and returned to the body through a duodenal tube, drunk in grape juice, or desiccated and given in capsule. If the escaping bile is purulent or contaminated, fluids, bile salts or ox gall are administered daily by mouth.

The operation may be done readily under local anesthesia. After delineation of the fistulous tract by the injection of a small quantity of ethereal methylene blue solution, the old scar with its contained segment of fistula is excised to the outer sheath of the rectus. Two vertical incisions 5 to 7 centimeters long are now made through the rectus muscle, one about 2 centimeters medial, the other about 2 centimeters lateral to the fistulous opening. The medial incision is deepened through the posterior sheath and peritoneum and the pyloric end of the stomach or duodenum, whichever happens to be the more accessible, is exposed, withdrawn through the wound, and opened. The small opening made is applied over the fistulous channel where it is held by two encircling rows of continuous or interrupted sutures uniting the serous surface of the duodenum to the outer sheath of the rectus. There is less danger of wound infection and separation if interrupted sutures of very fine (No. 35 B. and S. gauze) annealed alloy steel wire are used for suturing and tied in a square or surgeon's knot.

The vertical double pedicled flap of muscle with its contained fistula and attached stomach or duodenum is now rotated about 180 degrees to the left where it is fixed by suturing the lateral edge of its anterior sheath to the inner sheath of the adjacent medial segment of the rectus. Over the rotated flap the lateral and medial edges of the anterior sheath of the non-rotated portions of the rectus are united and the skin and fascia closed, preferably with No. 32 and No. 30 annealed stainless steel wire which may be buried in the anterior abdominal wall without secondary irritation. Postoperative adhesions may render it unnecessary to enter the free peritoneal cavity during this operation. As the retained fistulous tube is not disturbed or separated from its blood supply, necrosis is not to be feared. In several patients so operated upon, recurrence of the fistula or jaundice has not followed. While chiefly employed to provide a permanent by-pass for the bile to the alimentary canal, the operation may also be used as a temporizing or stage measure.

FRACTURES OF BOTH BONES OF THE FOREARM

A Method of Fixation

J. DEWEY BISGARD, M.D., Omaha, Nebraska

AMONG the difficulties encountered in the treatment of complete fractures of both bones of the forearm is that of maintaining adequate separation between the shafts of the radius and ulna to prevent synostosis and to preserve a complete range of rotation. The forces which rotate and draw the parallel fragments together and thus contribute to the factors which often make reduction possible only by open operation, continue to act after reduction. Consequently, there is a tendency for one or both bones to angulate in the direction of apposition at the sites of fracture.

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To resist these forces and thereby assure wide separation of the bones the author has used a method illustrated in the roentgenograms of two cases shown in Figures 1 and 2. In both cases reduction was accomplished by open operation, and the pins[1] which were used to fix the fragments and to hold the reduction were also utilized to maintain separation between the two bones.

[1]The pins and their method of use for fixation were devised by Dr. J. P. Lord and have been used for many years by Drs. J. P. Lord, Robert D. Schrock, and Herman F. Johnson, with excellent results and without inducing infection or other complications. The method has the advantage not only of simplicity in the application of the pins but also of the simplicity of their removal after union of the fracture has taken place. The free end of the pin is exteriorized so that it can be grasped with a forceps and removed without reopening the wound.

Fig. 1. Before and after reduction. Note that wide separation of the two bones is maintained by the fixation pins and that the free ends of these pins extend beyond the skin surface.

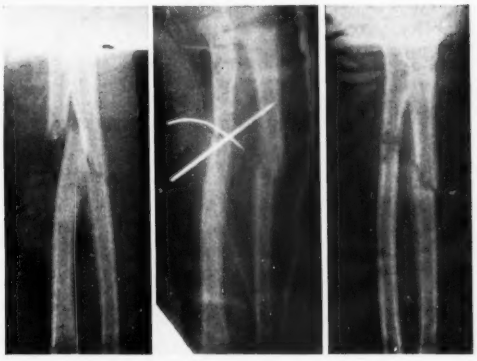

Fig. 2. Before and after reduction was obtained and after the fixation pins had been removed. It is to be noted that preservation of a broad interosseous space has been accomplished.

With the fragments held rigidly in complete end-on apposition, a hole the size of the steel pin to be used was drilled obliquely across the line of fracture in the plane intersecting both bones. The pin was then inserted through the drill hole and forced across the interosseous space until it contacted the opposite bone and had forced the two slightly apart. The pins are of sufficient length so as to protrude through the wound and beyond the skin surface where they can be grasped easily with a forceps and removed very simply when it is no longer necessary to retain fixation.

Objectionable is the possibility that the pins may injure large vessels, the ulnar, the deep branch of the radial or even the median nerve as they are forced across the interosseous space. To help prevent such an accident pins with smooth blunt ends were used in a case just recently treated.

Figure 1 shows roentgenograms of a boy of 7 years who fell 2 feet from the top of a fence July 14, 1936, sustaining simple complete fractures of both bones of the left forearm with overriding of fragments. Three days after injury and after three unsuccessful attempts at reduction by manipulation, the patient was referred to the University Hospital where a fourth unsuccessful attempt was made.

Five days later the fracture sites of the radius and ulna were exposed through separate incisions, the fractures reduced and fixed with pins, both of which were extended across the interosseous space. Eighteen days later there was roentgenographic evidence of union; both pins were removed without anesthesia during course of a dressing.

In Figure 2 are shown roentgenograms of a girl, aged 14 years, who fell down a stairway July 10, 1936, and suffered simple fractures of both bones of the left forearm with displacement and overriding of fragments of the radius. The patient was referred to the University Hospital 5 days after injury. The arm had been unsuccessfully manipulated three times, twice before and once after admission. At operation, the fragments of the radius were exposed, reduced and fixed with two pins, one extending across the interosseous space. Roentgenograms 18 days later demonstrated the presence of sufficient callus to permit removal of the pins.

RESECTION OF THE RIGHT HALF OF THE COLON

JOHN deJ. PEMBERTON, M.D., F.A.C.S., and LORIN D. WHITTAKER, M.D.,
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WITHIN recent years there have been many advances in the surgical treatment of diseases of the colon. Of the noteworthy factors which have contributed to its progress, the following may be mentioned: (1) earlier recognition and treatment of colonic diseases, made possible because of educational campaigns and also because of improved diagnostic methods; (2) pre-operative measures directed to rehabilitation of the patient and to decompression and cleansing of the colon; (3) intraperitoneal vaccination to fortify the patient's resistance to the spread of infection; (4) the employment of balanced anesthesia to insure relaxation without noxious effects of deep narcosis; (5) improvement in operative technique; and (6) the more general utilization of the principle of the multiple stage operation.

In spite of these advances, however, there are many pressing problems still confronting the surgeon and these must be solved before surgery of the colon can be considered on a plane equal to that of general abdominal surgery. In support of this it is necessary only to call attention to the high mortality following surgery of the right half of the colon as reported from various hospitals—15 to 30 per cent (1, 2, 3, 4, 5). When it is realized that among the most frequent causes of failure in colonic surgery are spread of infection (peritonitis) and intestinal obstruction, and since these are not always necessarily unavoidable complications, it is clear that there is at least a hopeful approach to the problem.

The success or value of certain surgical procedures, however, cannot be judged by the mortality alone. The question of what constitutes and what does not constitute an operable lesion influences the mortality. A low mortality will result when operation is performed in only highly selected cases, but certain patients will thus be denied surgical intervention which, if undertaken, would give them a good chance for recovery and restoration of health. A balance must therefore be maintained between what can safely be done on the one hand and the desire to help the patient toward recovery on the other.

From the Section on Surgery, The Mayo Clinic, and the Division of Surgery, The Mayo Foundation. Read before the meeting of Texas Surgical Society, Dallas, October 5 and 6, 1936.

Dr. Whittaker now resides at Bridgeport, Illinois.

The surgical problems presented by lesions of the right half of the colon differ in certain important respects from those of lesions in other segments of the large bowel. These differences are concerned chiefly with the character of the lesion and the type of operative procedure indicated. The tendency of lesions common to the right portion of the colon is to perforate rather than to obstruct, whereas lesions in other segments of the colon tend to obstruct early in their course. The operative procedure suitable for lesions of the right half of the colon is commonly limited to intraperitoneal resection of this part of the colon in whole or in part, together with re-establishment of the continuity of the intestinal tract by means of ileocolostomy. Lesions involving other segments, on the other hand, frequently can be removed by one of several types of procedure, such as by extraperitoneal resection, by an exteriorization operation, or by segmental resection. For reasons of safety the operation of resection of lesions involving the colon other than on the right side is today usually carried out in multiple stages, whereas for lesions on the right side, perhaps because of the absence of obstruction, the need for the graded procedure is not usually recognized.

The employment of the two stage procedure for resection of the right half of the colon, the application of certain underlying principles in deciding the type of anastomosis to be used, and the use of the present technique, which will be described, have combined to give a lower mortality and at the same time probably have increased the limits of operability. The basis of this study has been a series of 46 consecutive cases in which resection of the right half of the colon was performed by one of us (Pemberton) during the past 6 years. In 8 cases a single stage procedure was employed, in 38 cases a two stage procedure was used, employing the principles and technique to be described. In addition there were 5 cases in which ileocolostomy was performed.

METHOD

The type of anastomosis to be made at the time of ileocolostomy, or first stage, is determined by application of the following principles: In most of the uncomplicated cases lateral ileocolos-

tomy is preferable because of its safety. The danger of interference with the blood supply to the small bowel is obviated and a safety valve is afforded, for part of the fecal current will pass beyond the anastomosis through the normal channel. An end-to-side ileocolostomy is preferable under certain conditions: In the presence of a fecal fistula in the region of the cecum, ascending colon, or distal portion of ileum, this procedure is necessary in order completely to divert the fecal stream. Subsidence of the inflammatory reaction in the region of the fistula is thereby permitted, which will facilitate resection of the right half of the colon during the second stage of the operation. If the patient is thin, an end-to-side anastomosis may also be used when the cecal growth is intussuscepted and is causing pain (a side-to-side anastomosis will not relieve the pain). Likewise, in cases of inflammatory lesions of the terminal portion of the ileum, an end-to-side anastomosis often is preferred since it permits a greater subsidence of the inflammatory process (Figs. 1, 2, 3, 4, and 5).

The patient who is to undergo resection of the right half of the colon usually enters the hospital 2 days before operation for pre-operative preparation. Repeated irrigations are given by rectum on the day of admittance and on the day preceding operation. Likewise, a mild saline laxative is administered. During the afternoon and evening before operation paregoric is administered. The bowel is aspirated the morning of operation. A non-residue diet is permitted. Blood transfusions are given if needed to relieve marked anemia. In addition, it is the usual custom to introduce, intraperitoneally, 48 hours before operation, 1 cubic centimeter of a vaccine composed of killed Bacillus coli and Streptococcus hæmolyticus in 10 cubic centimeters of physiologic saline solution.

The first stage of the operation, as has been said, is ileocolostomy. A liberal incision is made through the inner third of the right rectus muscle and this extends about an equal distance above and below the umbilicus. The abdomen is explored and the lesion is examined to determine its nature, operability, and the type of ileocolostomy indicated. A loop of terminal ileum is selected about 6 or 8 inches (15 to 20 centimeters) from the ileocecal valve and approximated to the transverse colon. If side-to-side anastomosis is indicated, the anastomosis is made over rubber-covered clamps; two rows of chromic catgut are used and the anastomosis is reinforced with adjacent omentum. The anastomosis usually is made antiperistaltic. If an end-to-side anastomosis is indicated, the ileum is divided between clamps about 6 or 8 inches from the ileocecal valve. The distal end is then closed and replaced in the abdomen. The proximal end is approximated to the transverse colon, preferably by the use of a Rankin three-bladed clamp, which permits of a more nearly aseptic union. Again two rows of chromic catgut are used and the line of suture is protected as before. The omentum is then carefully replaced over the small bowel in its normal position and the abdomen is closed in layers without drainage.

The patient then remains in the hospital approximately 2 weeks. The time interval between stages is determined entirely by the condition of the patient, but usually he has begun to gain weight and is stronger, and the wound is sufficiently healed so that the second stage can be performed in about 3 weeks' time.

Pre-operative preparation for the second stage is similar to that for the first except that intraperitoneal vaccination is omitted, for it is felt that the ileocolostomy has brought about sufficient vaccination of the abdomen.

The location of the incision for the second stage, or resection, is of vital importance to the success of the operation. The incision is made lateral to the scar of the incision for ileocolostomy, through the outer third of the right rectus muscle. When the abdomen is opened, the omentum will be found adherent to the anterior abdominal wall at the site of the old incision, thus walling off the small bowel from the field of operation (Fig. 2). Approach to the right half of the colon is thus made through a compartment separate from the general peritoneal cavity. A small square gauze pack is placed at the lower angle of the wound to complete isolation of the field of operation.

Resection of the involved segment of bowel starts with separation of the lateral peritoneal reflexion to the right half of the colon. The blood supply to that portion of the terminal ileum and right colon to be resected is then clamped, divided, and ligated. After the cecum, ascending colon, and terminal 2 to 3 inches (5 to 7 centimeters) of the ileum have been freed from all mesenteric attachments, a decision must then be reached regarding disposal of that portion of the ileum distal to the previously made side-to-side ileocolonic anastomosis which is to be preserved. Unless some contra-indication exists, the terminal portion of ileum and proximal portion of transverse colon are approximated by means of a three-bladed clamp, the intervening segment of bowel involved by the lesion being removed by dividing the ileum and colon flush with the clamp, and then by means of an inverting stitch

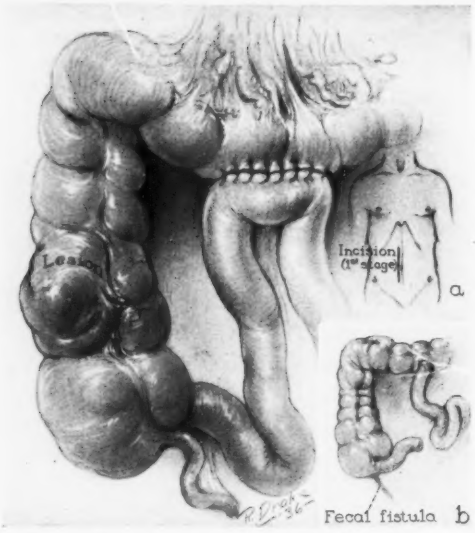

Fig. 1. First stage in resection of right half of colon, showing the usual side-to-side ileocolostomy: a, incision; b, end-to-side ileocolostomy (preferable in certain cases).

anastomosing the end of the ileum to the end of the colon. Thus a second ileocolonic anastomosis is made which affords an escape of that portion of the fecal current which passes beyond the

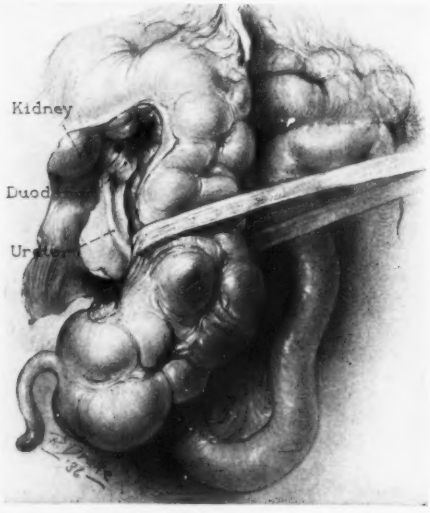

Fig. 3. Second stage in resection of right half of colon: separation of lateral peritoneal reflexion to the right half of colon, showing retroperitoneal structures to be avoided.

Fig. 2. Second stage in resection of right half of colon, showing omentum adherent to scar of first stage incision.

lateral anastomosis. In most instances this is the easiest and simplest method of disposing of the stumps of the ileum and colon (Fig. 4).

Conditions may exist, however, which make it unsafe to attempt this end-to-end union. For example, if the colon is greatly dilated at the site of the proposed end-to-end anastomosis, there will be a great disproportion in the size of the colon and ileum. Likewise, when the patient is obese and the mesentery is laden with fat, the added technical difficulties may be too great to establish an accurate and safe union. In the event that it seems unwise to make this union, the end of the colon and the end of the ileum are each inverted separately. In such a disposal of the end of the ileum it is important that the ileum be cut across close to the site of the anastomosis (¾ inch). If a longer segment of ileum is preserved distal to the side-to-side anastomosis, part of the fecal current will pass beyond the anastomosis into this segment, and then, because of peristalsis in this segment, there is danger that the end of the bowel will be blown out; or, if it holds, the peristaltic movements of the bowel will produce pains like those produced by any intestinal obstruction (Fig. 5). If the first stage procedure consisted of end-to-side ileocolostomy, the distal loop

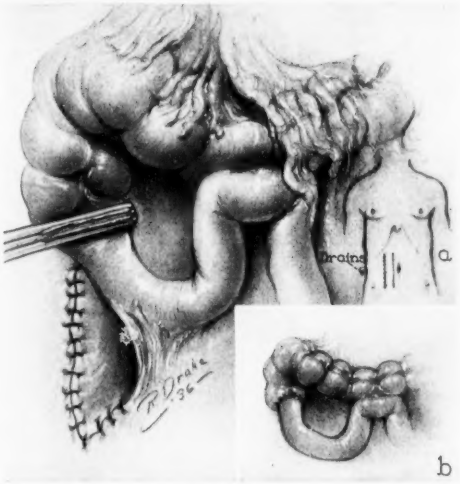

Fig. 4. Second stage in resection of right half of colon, showing completion of resection and beginning of end-to-end anastomosis of ileum to colon: a, positions of incisions and stab drain; b, completion of end-to-end anastomosis.

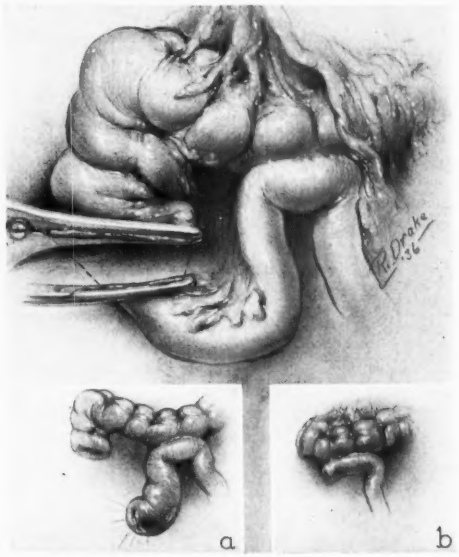

Fig. 5. Second stage in resection of right half of colon, showing marked disproportion between end of ileum and end of colon, preventing accurate end-to-end anastomosis: a, incorrect closure of ileum, giving rise to distended loop with possible perforation; b, correct closure of distal ileum close to site of ileocolostomy.

of ileum is removed with the cecum and ascending colon, and the proximal end of the colon is inverted. The amount of colon left proximal to the ileocolonic anastomosis is not of so much importance, for peristalsis runs away from and not to the remaining segment, as in the segment of distal ileum. The defect in the posterior peritoneum is closed, and the mesentery of the small and large bowel is approximated, if necessary. Through a stab wound in the right loin two Penrose drains are inserted, which insure dependent drainage.

It is customary to complete the second stage of the operation without seeing any loops of small bowel except that part to be resected, since, as has been indicated, resection is done in a separate compartment of the abdomen which can be said to be almost extraperitoneal in relation to the general abdominal cavity. Any drainage that may occur comes from the stab wound in the loin; the incision heals primarily in almost every case. Again, the stay in the hospital is about 2 weeks.

RESULTS

There were 2 deaths in the group of 38 cases in which the two-stage procedure was employed, giving a mortality of 5.2 per cent (Table I). These 2 patients who died had extensive perforating cancers of the right half of the colon, the inoperability of which was determined only after an attempt had been made to remove them. An abstract of these 2 cases is appended. Ileocolostomy, as a first stage procedure, was performed in 5 additional cases in which resection did not follow. There were 2 cases of borderline operability in which resection was impossible; in 1 case the wound was closed on exploration at the second stage because of the extent and fixation of the malignant growth; the other patient was not subjected to the second stage of the operation because of persistent marked debility. In the third case, that of an inflammatory lesion of the cecum, the patient showed improvement following ileocolostomy sufficient to warrant delay in further surgery. There were 2 deaths, one the result of pneumonia and the other of the unusual complication of thrombosis of the lower vena cava with clear ascites and right hydrothorax. These 4 deaths in the series of 43 cases in which two stage resection was performed or contemplated give a total mortality for both stages of 9.3 per cent.

The 2 deaths in the series of 43 cases in which ileocolostomy was performed and the 2 deaths in 38 of these cases in which second stage resection was carried out give comparable mortalities and illustrate the fact that the risk of resection of the

TABLE I.—RESECTION OF RIGHT HALF OF COLON (TWO STAGE OPERATION)

Diagnosis	Total	Males	Females	Age range, years	Operation				Operative findings							Course following:				
					Ileocolostomy		Resection									Ileocolostomy		Resection		
					Side-to-side	End-to-side	End-to-end	Closed ends	Fixed	Movable	Perforated	Obstructing	Intussuscepted	Marked inflammatory reaction	Nodes involved	Uneventful	Continued pain	Uneventful	Pulmonary symptoms	Fecal drainage
Carcinoma of cecum	11	6	5	36–75	11		10*	1	6	2	4	4	2	1	5	9	2	11		
Carcinoma of cecum and ascending colon	3	3		32–60	3		3			3		2				3		3		
Carcinoma of ascending colon	9	9		31–64	9		4	5	1	6	3	4	1		4†	7	1	5	2	2
Carcinoma of ascending colon (cecostomy)	1		1	48		1		1			1					1		1		
Carcinoma of hepatic flexure	2	2		41–67	2		1	1‡	1		2	1				2			1§	1
Carcinoma of hepatic flexure with duodenocolic fistula	1	1		52	1			1‡	1		1					1			1#	
Tuberculosis of cecum and ascending colon	2	1	1	26–55	1	1	1¶	1			1					2		2		
Granuloma of cecum and terminal ileum	3	2	1	32–54	1	2	1	2	1			2		2		3		2	1	
Regional ileitis	2	2		22–31		2		2		2		1				2		2		
Inflammatory granuloma with fecal fistula	3	2	1	20–30	2	1	2	1	2					3		3		3		
Fibroma of cecum	1		1	46	1		1			1						1		1		
Total	38	28	10		31	7	23	15	12	14	12	14	3	6	9	34	3	30	5	3

*Resection of portion of wall of bladder.
†Metastasis to liver—patient requested palliative operation.
‡Partial duodenectomy with duodenoplasty.
§Fatal massive collapse and pneumonia.
#Duodenal fistula—fatal pneumonia.
¶Resection of portion of greater curvature of stomach.

right half of the colon is no greater than that of the preliminary ileocolostomy. The clinical course following resection is distinctly quieter than that following ileocolostomy.

In this same period primary one stage resection of the right half of the colon was performed in 8 cases (Table II). In cases with distant metastasis in which the procedure was for palliation, in cases with marked bleeding from the malignant lesion, and in cases of a few thin patients with freely movable growths, it seemed advisable not to subject the patients to a second operation, and one stage resection accordingly was performed. Obviously, then, this group is not comparable to that in which two stage resection was carried out. There was 1 death, or a mortality of 12.5 per cent. The small number of cases, of course, gives little significance to the figure for mortality. The death in this group was secondary to peritonitis; no death in the group of cases in which two stage resection was performed resulted from peritonitis. In addition, the postoperative course in the one group was not comparable to that in the other. The postoperative course following one stage resection was distinctly more stormy, more critical and more prolonged than that following either the first or second stage of the two stage procedure (Figs. 6 and 7).

ADVANTAGES

The operation as carried out in two stages has certain advantages: The development of the separate compartment by adherence of omentum to the scar of the first incision and the subsequent placing of the second incision to enter into this compartment offer certain safeguards not available otherwise. In the first place, the handling of the small bowel, with the resultant trauma and possible spread of infection, is practically obviated, as the small bowel does not enter into the field of operation. If the end-to-end anastomosis or the blind, closed ends of ileum or colon should leak from any cause, or if there should be gross soiling during mobilization and resection of the involved bowel, the resultant infection will be confined to the compartment and can be controlled readily by the dependent drainage through the loin.

The clinical course following resection, which is the more extensive operation, usually is attended

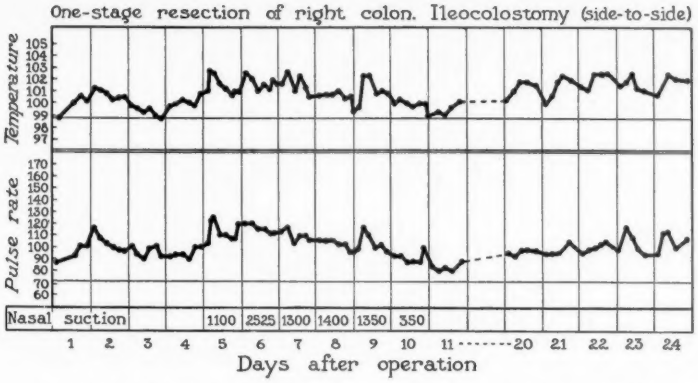

Fig. 6. Pulse rate and temperature following one stage resection of right half of colon. Ileocolostomy (side-to-side).

with less reaction than that following ileocolostomy. Figure 8 is a chart of the 38 cases in which patients were subjected to two stage resection and shows a composite of the daily mean temperature curves following each stage of the operation. The smoother clinical course that follows the second stage is best explained by the fact that manipulative trauma to the small bowel is avoided and any contamination associated with resection is localized in the separate compartment outside of the general peritoneal cavity, and perhaps also by the immunity acquired by vaccination of the peritoneum induced by the previous operation.

In cases of fecal fistula the advantages of the two stage operation are obvious. An end-to-side anastomosis diverts the fecal current from the fistula, permits marked subsidence of the associated inflammatory reaction about that portion of the bowel to be resected, and reduces to a minimum the discharge from the fistula. Furthermore, if resection of the bowel is necessary later, it is done in the aforementioned compartment separate from the general peritoneal cavity, thereby limiting to this compartment any spread of infection. The same is in general true in cases of an inflammatory lesion of the terminal portion of ileum and cecum, for example regional ileitis, typhlitis, and inflammatory granuloma of the cecum. A preliminary end-to-side anastomosis permits subsidence of the inflammation to a varying degree by diversion of the fecal current.

TABLE II.—RESECTION OF RIGHT HALF OF COLON (ONE STAGE OPERATION)

Diagnosis	Total patients	Males	Females	Age range, years	Operation			Operative findings							Postoperative course			
					Ileocolostomy (end-to-side)	Ileocolostomy (side-to-side)	Enterostomy	Fixed	Movable	Perforated	Obstructing	Intussuscepted	Marked inflammatory reaction	Lymph nodes involved	Uneventful	Ileus	Temporary obstruction	Fecal drainage
Carcinoma of cecum	3	3		29–64	2	1	3		3			1		1*	2	1†		
Carcinoma of ascending colon	2	2		34–49	1	1	1		2					1‡		1§	1	1
Tuberculosis of cecum	1	1		33		1	1			1					1			
Tuberculosis of cecum with cecal fistula	1		1	19	1		1	1					1		1			
Tuberculous ileitis	1		1	20		1	1#			1	1						1	
Total	8	6	2		4	4	7	1	5	2	1	1	1	2	4	2	2	1

*Peritoneal implants; palliative operation.
†Distended, passed no gas; died.
‡Metastasis to liver; palliative operation.
§Required nasal suction for 7 days, passed some gas; recovered.
#Symptoms of obstruction, emergency enterostomy; recovered.

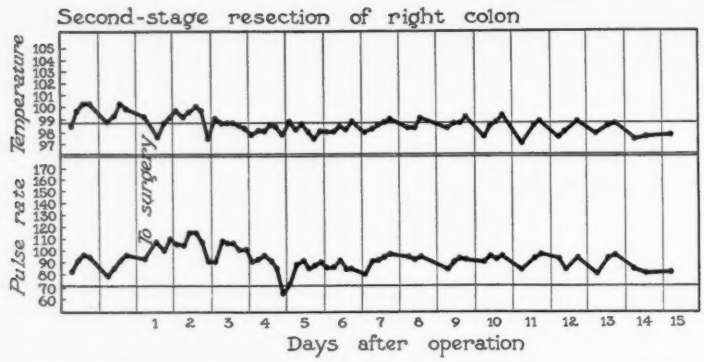

Fig. 7. Pulse rate and temperature following second stage resection of right half of colon.

The general condition of the patient improves following diversion of the fecal current, and thus if further operation is necessary the risk is reduced.

The value of this two stage procedure in which the second stage or resection of the colon is performed in a compartment separate from the general peritoneal cavity is further exemplified by those cases in which gross contamination occurred. Fecal drainage from the stab wound developed in 3 cases in this series following resection. Drainage was tolerated nicely, however, and in no case did ileus develop from infection secondary to leakage from the anastomosis. The clinical course was quiet. In 2 cases the fistula healed spontaneously within 2 or 3 weeks, respectively. In one fatal case there was drainage of bile, duodenal content, and seropurulent matter from the stab drain, yet peristaltic activity was not embarrassed. The bile and purulent drainage subsided, and at necropsy no evidence of generalized abdominal infection was found. Associated partial gastric resection was carried out in 1 case, and partial duodenectomy in 2 cases; convalescence was uneventful except in the fatal case, which will be described later.

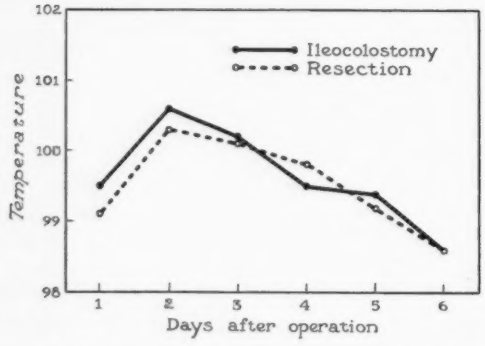

Fig. 8. Composite of daily mean temperature curves in 38 cases following each stage of the operation.

The value of end-to-side ileocolostomy with complete diversion of the fecal stream, which permits subsidence of the inflammatory reaction in the region of fecal fistula and thus facilitates the subsequent resection, is demonstrated by the following representative case:

A man, aged 20 years, had an inflammatory lesion of the cecum and terminal portion of ileum complicated by a fecal fistula. A side-to-side ileocolostomy was thought to be the safest procedure. The mass was markedly fixed. Two months later resection was advised, but at operation the mass was still fixed and the risk of resection was high. The distal portion of ileum, therefore, was divided and the anastomosis was converted into an end-to-side ileocolostomy to permit diversion of the fecal stream. There was marked subsidence of drainage from the fistula. At the time of resection, some time later, the growth was quite free and resection was done with minimal risk. Occasionally, in cases of an inflammatory lesion of the ileocecal region in which the pathological process is not too far advanced, end-to-side ileocolostomy permits of such improvement both clinically and roentgenologically that resection may prove unnecessary.

ABSTRACT OF TWO CASES IN WHICH PATIENTS DIED

The two cases in which the patients died following the second stage of the two stage operation are presented in some detail. As stated before, it becomes difficult at times to maintain a balance between the desire to give each patient his chance of cure and what must be considered an inoperable condition. In both these cases the operability must be considered questionable at best:

CASE 1. A man, aged 67 years, in poor health, was subjected to side-to-side ileocolostomy for carcinoma of the

hepatic flexure of the colon on October 3, 1935. The growth was the size of a double fist (about 10 centimeters in diameter) and was fixed. Convalescence was slow, and the patient was permitted to return home in the hope that he might gain more strength. After 2 months he returned very little improved and weakened by diarrhea. The risk of operation was graded 3 on a basis of 4. The abdomen was explored and the right half of the colon resected on December 2, 1935. The growth had perforated necessitating its separation from the liver, posterior abdominal wall, and retroperitoneal portion of the duodenum. The patient's immediate postoperative course was satisfactory until the third day, when definite collapse of the right lower lung developed. He passed some gas, but the abdomen was slightly distended. Death came on the sixth postoperative day and was thought to be due to pulmonary complications.

CASE 2. This second case was very interesting and again demonstrated to us the value of the two stage procedure. The patient, a man, aged 52 years, entered the clinic complaining of loss of weight, anemia, and diarrhea. He was found to have carcinoma of the hepatic flexure; this had perforated and a fistula with the second portion of the duodenum had resulted. Ileocolostomy, side-to-side, was performed on June 11, 1936. The fistula was noted, and a fixed mass, the size of a fist, was found in the colon. The lesion was thought probably to be inoperable. The patient, however, made a splendid recovery from the ileocolostomy and gained weight, and it was thought best to attempt resection, which was carried out July 9, 1936. Exposure of the mass revealed its extensiveness and fixity, and once it was exposed it was necessary to continue with the resection. The growth was separated from the liver, leaving much raw surface. The fistula was excised, and an opening 6 by 4 by 3 centimeters in the duodenum (which was left) was closed. The growth was perforated during resection and some gross soiling took place. The immediate postoperative course was quite gratifying. The patient passed gas and liquid stools on the third day and continued to do so. Bile and seropurulent drainage from the stab drain in the loin persisted for a few days. A duodenal fistula developed on the sixth postoperative day, but this was controlled with suction. Bronchopneumonia, graded 3+, developed, and death occurred on the twenty-second postoperative day. Necropsy revealed the presence of the fistula, but the abdominal cavity was free of infection. No carcinoma was found.

Here, then, are 2 cases in which there were extensive growths and in which the patient was subjected to extensive surgery with obvious soiling, grossly in 1 case, yet death was due to pulmonary complications. Had it been necessary to handle the small bowel, with exposure of the general peritoneal cavity, death no doubt would have ensued promptly from peritonitis.

SUMMARY AND CONCLUSIONS

The employment of the two stage operation for resection of the right half of the colon and the application of the principles and technique described have combined to give a lower mortality in surgery of the right half of the colon and at the same time have undoubtedly increased the limits of operability.

In a consecutive series of 38 cases second stage resections of the right half of the colon were performed, with 2 deaths, or a mortality of 5.2 per cent. Ileocolostomy, as a first stage procedure, was performed in 43 cases, with 2 deaths. These 4 deaths in the series of 43 cases studied give a total mortality for both stages of 9.3 per cent. There were no deaths secondary to peritonitis.

Resection of the right half of the colon as the second stage is the more formidable procedure, but it has been performed at no greater risk and with less reaction than the preliminary stage of ileocolostomy.

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THE TREATMENT OF THROMBOPHLEBITIS

With Acetyl-Beta-Methyl Choline Chloride Iontophoresis

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THROMBOPHLEBITIS constitutes one of the most stubborn and disabling conditions affecting the lower extremities. Despite the many forms of treatment, including long periods of rest in bed with elevation of the legs and the use of supportive bandages which have been recommended during the past 50 years, in a large percentage of these cases healing fails to occur. In many instances there continues a low grade, smoldering condition which is easily activated by traumatism or by prolonged standing. In others the condition becomes chronic with a superimposed lymphedema of the entire extremity. In this report a new method of treatment of thrombophlebitis which appears to be more satisfactory than any hitherto suggested is described.

ETIOLOGY

Thrombophlebitis is an inflammation of the vein wall with a secondary thrombosis due to changes in the endothelium. According to Karsner, the vein may be involved in the inflammatory process either directly or through the medium of lymphatics; i.e., there may be a lymphangitis involving the veins. There are the suppurative and non-suppurative types of thrombophlebitis. Slowing of the blood flow is a predisposing factor in the causation of this condition. Thrombophlebitis is quite common following a prolonged stay in bed from any cause. It is also frequently found after operation, and especially after pelvic operations. Febrile diseases, such as pneumonia, typhoid fever, and especially influenza are frequently complicated by thrombophlebitis. Anemia and increased coagulability of the blood predispose to the development of this entity. Trauma in the presence of a quiescent phlebitis is very often the exciting cause of a recurrence of the acute stage. Syphilis, gout, and tuberculosis have been found to be associated frequently.

PATHOLOGY

Because of the anatomical relationship of the veins of the left lower extremity, this member, when the condition is unilateral, has been most frequently involved. In the majority of cases, however, both legs are involved. The involvement may vary in degree from the presence of a small nodular thrombus to that of the most severe type of thrombophlebitis, e.g., phlegmasia alba dolens, in which the iliac or femoral vein is blocked. Also, in some cases the onset may be sudden, acute, with the typical fever, chills, and excruciating localized pain, while in others the symptoms are mild, but there are noted the persistent tiredness, soreness, and occasional ankle edema after prolonged standing.

According to Leriche pain, edema, and functional impotency in phlebitis come from a disturbance of the innervation of the vascular wall, "an excitation of a sensible nerve, which plays a more important part than the mechanical obstruction of the blood stream." Thus the spastic element of phlebitis plays an important rôle in the pathogenesis of the attending functional trouble.

Aside from the pain associated with thrombophlebitis, there are other changes which are dependent on venous and lymphatic obstruction, i.e., edema of the subcutaneous tissues of varying degrees from a transient ankle edema to a persistent brawny edema of the pseudo-elephantiasis type, from the ankle to the groin. In the chronic form this edema has been found to persist over a period of 20 years in some cases.

TREATMENT

Logically the clearing up of a thrombophlebitis with venous and lymphatic obstruction should be dependent on an increase in the local circulation, the elimination of the local edema, and the relief of pain, without increasing the danger of the formation of emboli. In the acute stages of thrombophlebitis the practice of anything but the most conservative and classical methods would be contrary to all known principles. The patient should be given absolute rest and the limb, elevated to avoid the danger of pieces of soft thrombus being dislodged and thrown into the general circulation. When the thrombus is firm, however, as we find in the long standing or afebrile cases, treatment may be instituted toward the relief of pain due to venospasm and toward the improvement of circulatory imbalance by aiding the local circulation in the elimination of the local edema. Many of the previous forms of treatment, such as rest

From the Vascular Clinic of St. Mary's Hospital.

and elevation of limb, the use of elastic bandages, rubber stockings, or "Unna's boot," ligation of veins, have been used as controls in this series in an attempt to promote this physiological state but without satisfactory results.

A group of workers (1) at the Post Graduate Hospital has recently reported successful results in the use of acetyl-beta-methyl choline chloride[1] by the method of iontophoresis in the treatment of chronic varicose ulcers (4), by which the local circulation was stimulated very effectively. Thrombophlebitis is a closely associated condition and is very often found to precede the formation of chronic varicose ulcers. In the vascular clinic of St. Mary's Hospital we have collected a series of 33 cases followed over a period of 1 year in which this method of treatment alone was used. These patients had had the thrombophlebitis for from 1 week to 20 years without relief from any previously used treatment. The average age of the patients in the series was 52.6 years. The average number of treatments given was 15, with a minimum of 4 in Case 6, and a maximum of 63 in Case 13. This latter patient had a severe, long standing chronic phlebitis with marked lymphedema and also a large varicose ulcer of the leg (10 by 8 centimeters). The average period of treatment was 6.7 weeks with treatments given two to three times per week.

In this report we present the results of the treatment of the first 33 consecutive cases of thrombophlebitis that have come under our care since we began this form of treatment. No selection of cases was undertaken. We would stress the following conditions of our experiments:

1. Our patients had been through a period of control ranging from 1 week to 20 years during which time all recognized forms of treatment for this condition had been tried on one or more of them without success.

2. During our period of treatment only 4 patients were hospitalized or put to bed. These came to us with such severe pain due to the thrombophlebitis that they were unable to work, but not one of these was required to stay more than 1 week in the hospital. They were all urged to go about their usual work.

3. No other form of treatment was used with the possible exception of the comforting support of an ace elastic bandage for the first week or two, after which it was discarded.

4. No patients with acute thrombophlebitis with fever, chill, etc., is included in the series as we believe it would not be wise in these to attempt any treatment other than rest and elevation. However, after the febrile stage had subsided we instituted this form of treatment with no untoward results and a shortening of the period of disability.

5. In the evaluation of the degree of disability caused by the thrombophlebitis in each case, a relative scale of from one plus (1+) to four plus (4+) was used, one plus indicating but slight subjective discomfort in getting about at their usual daily routine, and four plus indicating a complete disability. Some of these latter patients had to be hospitalized, the others were able to come to the clinic on crutches or via wheel chair from their auto to the treatment room, especially during the early course of the treatments. The other degrees are estimated proportionately.

6. The results obtained are classed as improved or not improved depending upon, (1) the objective signs such as disappearance of tenderness along the involved veins, loss of edema, and healing of ulcers, and (2) subjective symptoms of loss of pain, of tiredness, and of heaviness of the legs after their usual hours of routine work. The relative grade of improvement is scaled proportionately in the results obtained.

[1] Drug supplied through kindness of Merck & Co.

MECHANISM OF HEALING, PRECAUTIONS

The mechanism by which this healing is accomplished is not clear. Three explanations may be advanced. The results may be due to any one or a combination of the three. First, the production of an increased local circulation may promote a more rapid removal of the waste products and increase in local nutrition thus producing regeneration of the tissues; second, the marked local diaphoresis, which may continue for from 4 to 8 hours after the treatment, may reduce the edema resulting from the hydrostatic pressure and, by relieving the tissues of this overload of fluid, may permit healing; or, third, the relief of the spastic element of the phlebitis may lessen the disturbance of the innervation of the vascular wall which plays a part in the mechanical obstruction of the blood stream. In these cases, injection of veins is a definite contra-indication until long after the active phase is passed, and, even then, there is danger of recurrence and embolism. No active form of treatment such as massage, heat or diathermy, may safely be given to favor healing. It is therefore of benefit that some safe method of therapy may be used not only for the relief of pain, but also for the re-establishment of a balanced circulation in these affected limbs.

When one considers the lack of success that has accompanied the treatment of chronic thrombophlebitis heretofore and the encouraging results

TABLE I.—THE TREATMENT OF PHLEBITIS WITH ACETYL-BETA-METHYL CHOLINE CHLORIDE IONTOPHORESIS

Patient	Age Sex	Type phlebitis	Duration	Disability	Etiology	Duration of treatment	No. treatments	Result	
1 W.B.	68 M	Chronic bilateral and lymphedema	20 yrs.	++	Appendectomy	7 mos.	36	Improvement	++
2 A.K.	28 F	Acute bilateral deep femoral	3 yrs.	++++	Thyroidectomy	2 wks.	9	Little improvement	—
3 C.T.	53 F	Subacute bilateral	10 mos.	+++	Cholecystectomy	8 mos.	22	Improvement	+++
4 G.H.	40 M	Chronic left leg and lymphedema	16 yrs.	++	Influenza	2 mos.	16	No edema	++
5 M.T.	38 F	Subacute bilateral	2 yrs.	++++	Grippe	6 wks.	8	Improvement	++++
6 A.C.	68 F	Subacute bilateral	3 mos.	+++	Colitis, auricular fibrillation	1 wk.	4	Improvement	++
7 A.M.	54 F	Subacute bilateral	1 mo.	+++	Chronic sinusitis	9 days	5	Improvement	+++
8 J.T.	50 M	Chronic bilateral lymphedema and ulcer	2 yrs.	+++	Pleurisy	3 mos.	20	No edema	+++
9 M.G.	63 F	Subacute bilateral	2 mos.	+++	Cholecystitis	6 wks.	17	Improvement	+++
10 E.H.	57 F	Subacute bilateral	11 mos.	++	Colitis	3 mos.	12	Improvement	++
11 A.D.	49 F	Subacute bilateral	15 yrs.	+++	Influenza	2 mos.	11	Improvement	+++
12 P.B.	39 M	Chronic bilateral and multiple ulcers	12 yrs.	++++	Pulmonary tuberculosis	17 days	17	Ulcers heal	++++
13 W.T.	48 M	Chronic left leg, lymphedema, and ulcer	3 yrs.	++++	Traumatic varicose ulcer	5 mos.	63	No edema	+++
14 A.R.	49 M	Chronic bilateral and lymphedema	1 yr.	++	Sinusitis	2 mos.	26	No edema	++
15 M.F.	54 F	Acute bilateral	7 yrs.	++++	Trauma	1 mo.	16	Improvement	++++
16 J.L.	55 F	Subacute bilateral	1 yr.	++	Cholecystitis	2 mos.	10	Improvement	++
17 A.B.	63 F	Subacute in left leg	3 mos.	+++	Influenza	1 wk.	5	No improvement	—
18 D.S.	38 F	Subacute in left leg	1 mo.	++	Trauma	1 wk.	6	Improvement	++
19 G.K.	58 M	Chronic left leg, lymphedema and ulcer	20 yrs.	++++	Typhoid fever	3 mos.	50	No edema	+++
20 G.D.	50 M	Subacute in left leg	1 mo.	++	Strain	1 mo.	12	Improvement	++
21 J.O'C.	63 F	Acute in right leg	2 wks.	+++	Overexertion	1 mo.	11	Improvement	+++
22 S.Z.	70 F	Chronic left leg, varicose ulcers	1 wk.	++	Standing	1 mo.	19	Ulcer healing	++
23 A.S.	45 F	Subacute bilateral	2 yrs.	++	Standing	12 days	8	Improvement	++
24 B.K.	72 F	Subacute bilateral	8 yrs.	++	Colitis	1 wk.	6	Improvement	++
25 E.G.	41 F	Subacute bilateral	1 yr.	+++	Hysterectomy	6 wks.	12	Improvement	+++
26 E.F.	52 F	Acute bilateral	7 yrs.	++++	Hypertrophic arthritis	2 wks.	9	Improvement	+++
27 T.B.	36 F	Subacute bilateral	2 mos.	++	Injection	2 wks.	16	Improvement	++
28 A.L.	68 F	Chronic bilateral	9 mos.	++	Hypertrophic arthritis	5 wks.	16	Improvement	++
29 K.G.	71 M	Subacute in left leg	6 mos.	++	Arterial occlusion	1 mo.	15	Improvement	++
30 E.S.	45 F	Acute right leg, varicose ulcers	4 mos.	++++	Trauma	10 days	5	Improvement	+++
31 M.K.	49 F	Subacute bilateral	2 yrs.	++	Influenza	1 mo.	9	Improvement	++
32 M.M.	52 F	Subacute bilateral	3 yrs.	+++	Cholecystitis	1 wk.	6	Improvement	+++
33 G.H.	48 F	Subacute bilateral	1 mo.	++	Hysterectomy	1 wk.	6	Improvement	++

shown in practically all of the cases herein reported, this method warrants further study and clinical use.

TECHNIQUE (4)

A standard 0.5 per cent solution of acetyl-beta-methyl choline chloride is used. Reinforced asbestos paper saturated with the 0.5 per cent solution of the drug is wrapped around the foot and leg as high as the thigh. A malleable metal plate is placed over the wet asbestos paper and is connected to the positive pole of a galvanic machine. A large, regular, moist electrode is used as a dispersive electrode. This is placed under the back and is connected with the negative pole. The current is turned on slowly and increased to 20 or 30 milliamperes. At the end of the treatment, the current is slowly reduced and turned off. Treatment is given in some cases daily, but generally, for from 20 to 30 minutes, two to three times weekly.

General reactions. A moderately severe reaction resulting from this iontophoresis treatment might be characterized by (1) a marked flush extending over the face, chest, and upper part of the abdomen; (2) increase in the pulse rate; (3) a deeper, slower respiratory cycle; (4) a marked drop in the blood pressure (which has been so profound on several occasions that it was necessary to terminate the experiment with atropine); (5) marked salivation (in one instance as much as 140 cubic centimeters of saliva was collected in 20 minutes); (6) marked lacrimation; (7) profuse diaphoresis; (8) increased intestinal peristalsis with abdominal griping and occasional immediate defecation; (9) occasional substernal pressure; (10) diuresis, in certain individuals, to a varying degree; (11) slight cyanosis of the tips of the extremities, with a drop in the surface temperature, which usually rises above the original level in from 1 to 6 hours. If desired, immediate cessation of effects may be produced by the injection of atropine, one one-hundredth grain (0.00065 gram) subcutaneously.

These systemic reactions constitute an exact duplicate of the reactions following the subcutaneous or intravenous administration of the same drug but are more certain, more prolonged, and more easily controlled. They are rarely noted with iontophoresis except in the mild form.

Local reactions. In addition, there is a characteristic local reaction, directly under the site of the application of the drug. This consists of (1) a feeling of prickling followed by warmth during the treatment; (2) the appearance of goose-flesh immediately after the removal of the asbestos paper; (3) a local blush of the skin; (4) sweating of the skin, which may continue from 6 to 8 hours; (5) an elevation in surface temperature, during treatment, followed by a drop during profuse sweating (with accompanying evaporation) and a rise above the former level in from ½ to 5 hours.

Neither the general nor local effects noted can be produced with the use of saline iontophoresis or by the galvanic current alone. Likewise they cannot be produced by merely soaking the area in a solution or by using an ointment containing up to 25 per cent of the drug. Acetyl-beta-methyl choline chloride solution plus the use of the galvanic current must therefore, be responsible for the effects.

Individuals vary in reactions, as in the use of most drugs. Some individuals who scarcely react to the first treatment show an increasing reaction to subsequent treatments.

RESULTS

Acetyl-beta-methyl choline chloride iontophoresis has been used in the treatment of 33 cases of thrombophlebitis. The age, type, duration, and degree of disability, duration and number of treatments, and the results are given in Table I. Thirty-one patients were definitely improved and were able to get about with ease and without the aid of any supporting bandages whatever. Of 488 treatments given, not one untoward reaction was noticed. Cases with lymphedema cleared up remarkably in a comparatively short time after years of progressive discomfort. Associated varicose ulcers healed readily. This confirmed the reports from the vascular clinic of the New York Post Graduate Hospital (4).

The 2 cases in this series with unsatisfactory results had received too few treatments to give the method a fair trial. Their case histories follow:

CASE 2. A. K., a young woman of 28 years, had a severe acute bilateral thrombophlebitis of 3 years' duration, involving the deep femoral and iliac veins. This condition followed a thyroidectomy and resulted in complete disability due to pain. She also had a severe secondary anemia with a hemoglobin of 50 per cent and a hypothyroidism with a basal metabolic rate of −20. She came to the clinic for four treatments over a period of 2 weeks and then stopped because of the great effort necessary for her to attend. She was advised to enter the hospital but did not follow this advice.

CASE 17. A. B., a woman of 63, had a subacute thrombophlebitis involving her left leg, of 3 months' duration and with a disability graded as 3+. An attack of influenza preceded the onset of her disability. She was given 5 treatments in 1 week with little or no improvement. She left this vicinity due to some family situation, with her treatments incomplete. She expects to return at a later date for further treatments.

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A MODIFIED SIEVE GRAFT

A Full Thickness Skin Graft for Covering Large Defects

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IN 1930, Beverly Douglas described in this Journal[1] a method for transplanting relatively large full thickness skin grafts, which he first devised and used in 1928. He called it a "sieve graft method because the graft is uniformly perforated with small round openings." The advantage of the method to which he drew attention was that it provided for adequate drainage, prevented the accumulation of serum or exudate between the graft and underlying bed, and so afforded a better opportunity of overcoming wound infection. The method of preparing the graft was so devised as to leave behind numerous small islands of skin from which regeneration could occur making it unnecessary to treat further the donor site. We used the method of Douglas a number of times and became impressed with its practical value. It retained the advantages of the Wolfe-Krause full thickness graft in preventing contracture and providing a new skin surface resistant to minor injuries while also affording a higher incidence of takes, especially in the presence of a moderate infection.

The method which we wish to describe in this report retains the advantages of the perforated full thickness graft of Douglas while it greatly facilitates healing of the donor site. In addition the graft is easier to prepare, requires no special instruments, and the operation is much less time consuming. The wound to be grafted is prepared in the usual manner. An oval-shaped transplant as illustrated in Figure 1, a, is then prepared, care being used to secure the full thickness of skin with none of the subcutaneous fat. The long axis of the graft should be about one-third longer than the long axis of the wound to be covered. The lax skin of the abdominal wall furnishes an excellent donor site, and since the wound is elliptical it can be readily closed, usually without undercutting. As soon as secured the graft is placed, dermal side down, on a smooth towel moistened with physiological salt solution, and then with a small sharp scalpel numerous short incisions are made as illustrated in Figure 1, b. These incisions should be overlapping and when completed permit the graft to be stretched into any desired shape. In practice we have found that the original graft need not be more than one-third to one-half the width of the defect to be covered. The transplant is sutured into place and pressed into firm contact with the underlying bed. Vaseline gauze is then placed over the graft and covered with flat gauze and sea sponges in the manner advocated by Blair. The sponges are removed in 7 days and the graft is inspected. Stitches are removed and the compression dress-

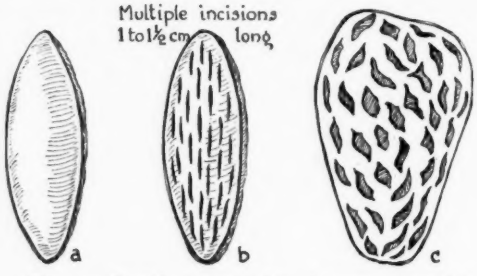

Fig. 1. a, Oval shaped transplant; b, numerous overlapping incisions; c, graft stretched to shape of area to be covered.

From the Department of Surgery of the University of Chicago.

[1]Douglas, Beverly. Surg., Gynec. & Obst., 1930, 50: 1018-1023.

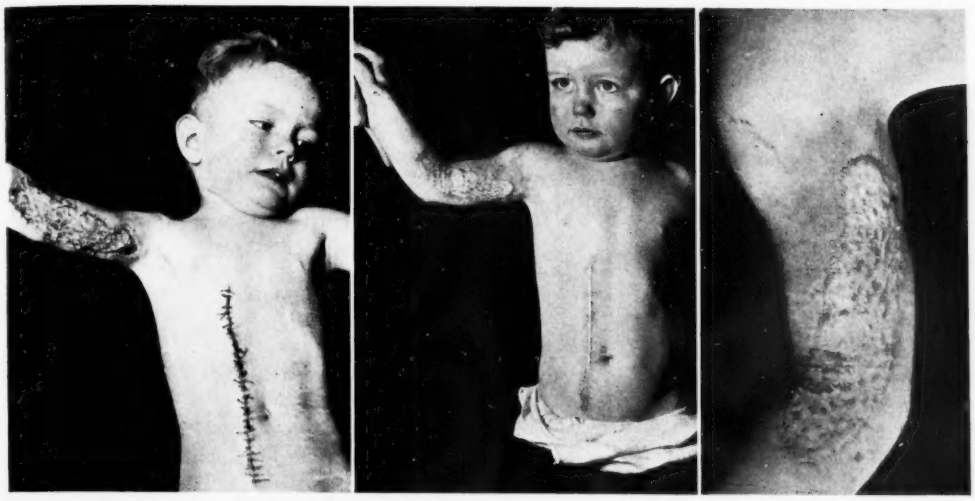

Fig. 2. Appearance of wounds in Case 1 in 7 days and in 25 days after operation.

Fig. 3. Condition of wound in Case 2 in 9 days and in 30 days after operation.

ing is reapplied for another week, when ordinary dressings are used. The donor site has invariably healed within a week or 10 days and this fact constitutes one of the chief advantages of the method.

The following abstracts of case histories illustrate our experience to date.

CASE 1. Unit No. 92936. S. M., male, aged 27 months. Eighteen hours before admission the right arm was caught in a clothes wringer. On examination a hematoma was found on the volar aspect of the arm extending from the axilla to just below the elbow and the entire extremity was markedly swollen. The skin was cleansed with water and alcohol and sterile dressings were applied. Twenty-four hours later an area of necrosis 5 centimeters in diameter appeared in the cubital fossa. This area extended gradually to the axilla. Operation was done 9 days after the injury. The necrotic tissue, skin and subcutaneous tissue, was excised leaving a large wound on the volar aspect of the arm extending from the cubital fossa to the axilla. A full thickness graft, elliptical in shape, was taken from the anterior abdominal surface, treated as described, and sutured into the defect. The abdominal wound was closed and healed in 8 days. All of the transplant took except for a small area of separation at the upper angle. This was resutured and the wound was entirely healed in 18 days. The photographs which are shown in Figure 2 give the appearance of the wounds in 7 days and in 25 days after operation.

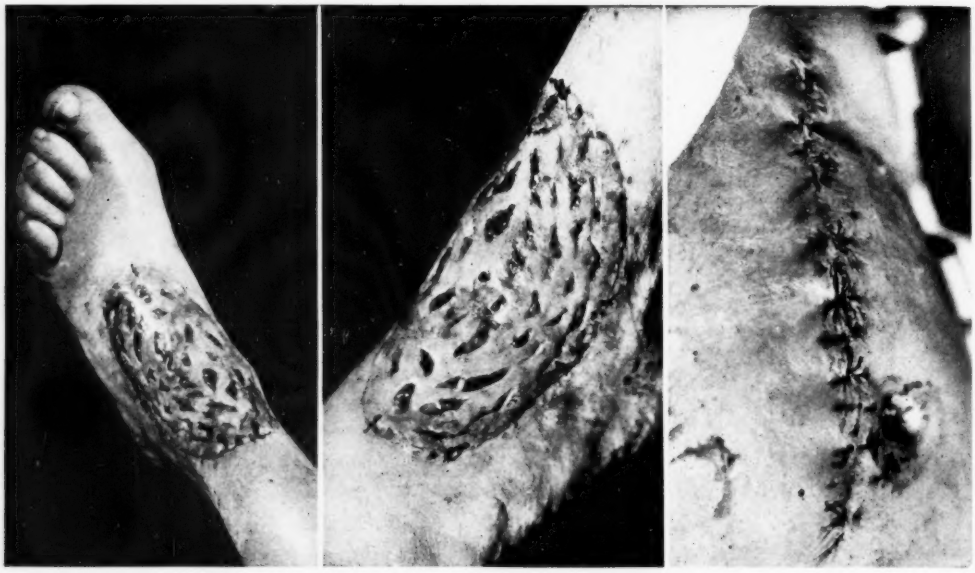

Fig. 4. Condition of transplant and donor site 10 days after operation.

CASE 2. Unit No. 141835. C. M., female, aged 53 years. Following a radical mastectomy for carcinoma of the breast, a defect (11 by 5 centimeters) remained in the incision which could not be closed. A full thickness transplant was taken from the neighboring lax skin of the abdomen and was sutured into the wound. Figure 3, left, shows the condition of the wounds at the end of 9 days, and, right, at the end of 30 days.

CASE 3. Unit No. 120649. L. L., female, aged 55 years. A melanoma was excised from the dorsum of the left foot leaving a defect extending from just above the ankle to the mid-portion of the foot and measuring 12 by 7 centimeters. A full thickness graft from the abdominal wall was sutured into place, and although the wound became infected the entire transplant survived. The photographs in Figure 4 show the condition of the transplant and the donor site 10 days after operation. The transplant was completely healed in 30 days.

SUMMARY

The description of a simple, practical method for using full thickness skin grafts to cover relatively large defects is given. The method described utilizes the "sieve graft" principle of Beverly Douglas.

MUSCLE-SPLITTING EXTRAPERITONEAL LUMBAR GANGLIONECTOMY

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SINCE the pioneer work of Royle in 1924, the extraperitoneal approach to the lumbar sympathetic ganglia has gradually gained favor over the transabdominal route. It has the advantages of lower mortality and smoother postoperative course which outweigh the disadvantage that only one side can be done at a time. In the transabdominal approach it is sometimes very difficult to remove the second right lumbar ganglion. All the serious complications which are apt to follow intra-abdominal surgery may follow the transabdominal route.

In the Royle approach (Fig. 1) the external oblique and internal oblique muscles are separated from their attachments to the iliac crest by cutting directly across their fibers close to their insertions. This tends to increase tissue reaction and to favor the accumulation of serum. Attempts to approximate the retracted ends cause strangulation and additional trauma to the divided muscles. These factors predispose to delayed healing, infection, and the possibility of incisional hernia.

Since 1934 the author has been concerned with improving extraperitoneal lumbar ganglionectomy by the development of a completely muscle-splitting approach. In all, three incisions have been developed on fresh cadavers and subjected to clinical trial. Two early methods, to be mentioned later, have been discarded in favor of the following operation:

Anesthesia. Subarachnoid block is preferable because it gives complete muscle relaxation.

Step 1. The patient is placed supine with the side of operation slightly elevated 5 or 10 degrees by one small pillow placed under the homolateral hip (Fig. 1). Fine black silk is used throughout. A straight incision (Fig. 3) about 18 centimeters long is then made through the skin and subcutaneous tissues in the direction of the fibers of the external oblique muscle, 4 centimeters mesad to the anterior superior iliac spine, and extending from the lower costal margin to midway between the anterior superior iliac spine and the pubic spine. The fascia of the external oblique muscle is exposed, but no attempt is made to undercut the subcutaneous tissues.

From the Clinic of Sympathetic and Vascular Surgery, Mount Zion Hospital, San Francisco, Surgical Service of Dr. Harold Brunn.

Step 2. The external oblique muscle and fascia are then split over the full extent of the incision in the direction of their fibers. The muscle is dissected carefully from the underlying internal oblique muscle, being careful to undercut only as much as is necessary to expose the line of split in the internal oblique. Retractors are placed to expose the internal oblique at the desired site.

Step 3 (Fig. 4). The internal oblique muscle is then split in the direction of its fibers at such a point that the line of split points to the body of the second lumbar vertebra. The point is important in allowing exposure of the medial lumbocostal arch because of the drag on the retractors produced by the upper flap of the external oblique. The flaps are freed from the underlying closely attached transversalis muscle and fascia, and retractors are placed so as to expose about

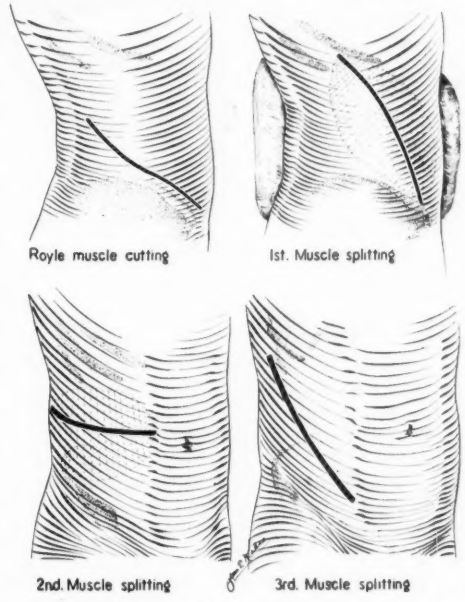

Fig. 1. Incisions used in the Royle muscle-cutting and the various muscle-splitting approaches. Note the wide area of undercutting of skin and subcutaneous tissue in the first and second approaches. No undercutting is necessary in the final (third) muscle-splitting operation.

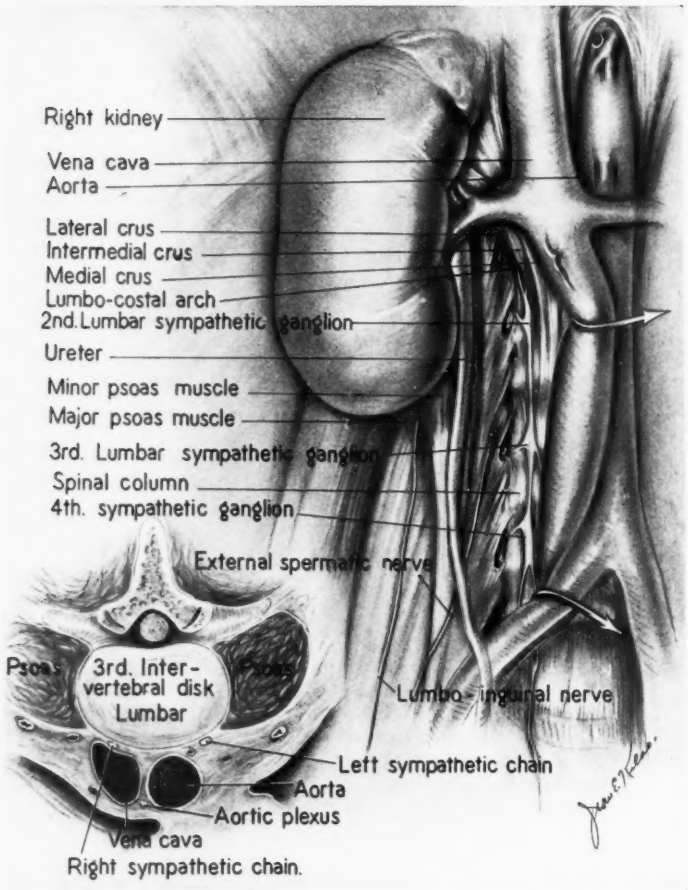

Fig. 2. Important anatomical relations involved in lumbar ganglionectomy. Note that the second ganglion is the highest ganglion usually seen. The first ganglion is hidden under the musculature of the lumbocostal arch. Also note that the rami of the second ganglion are directed cephalad, whereas those of the third and fourth ganglia are directed caudad or transversely. The inset shows the left sympathetic chain just lateral to the aorta, whereas the right sympathetic chain lies directly under the vena cava.

15 centimeters of the latter at the level of the body of the third lumbar vertebra and in the direction of its fibers.

Step 4 (Fig. 5). The transversalis muscle and its fascial continuation are split in the direction of their fibers for about 15 centimeters, the mesial limit being at the lateral border of the rectus sheath. The retroperitoneal fat is thus exposed. In splitting this layer, care must be taken not to injure the peritoneum. It is best to begin the split posteriorly and to extend it carefully anteriorly. The peritoneum is the more easily torn as it nears the rectus sheath.

Step 5 (Fig. 6). The retroperitoneal fat containing the ureter is then freed from the underlying tissue with the hand. Care must be taken that the dissection is carried anterior to the fascia covering the quadratus lumborum and the psoas muscles. It is easy to carry the dissection deeply in the wrong plane if this is not borne in mind. The retroperitoneal fat is dissected mesad to the bodies of the vertebræ, cephalad to the crura of

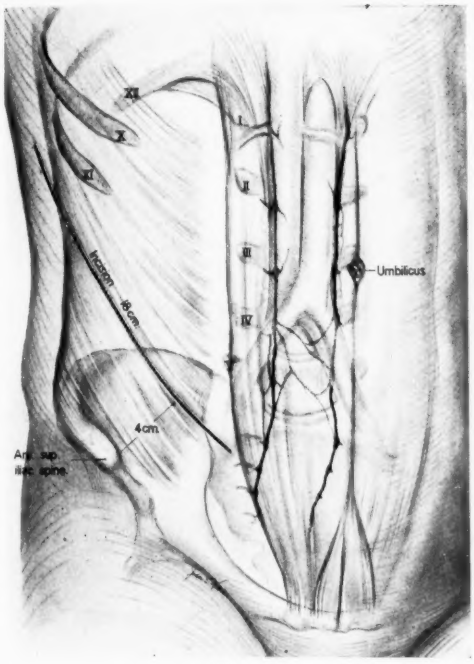

Fig. 3.

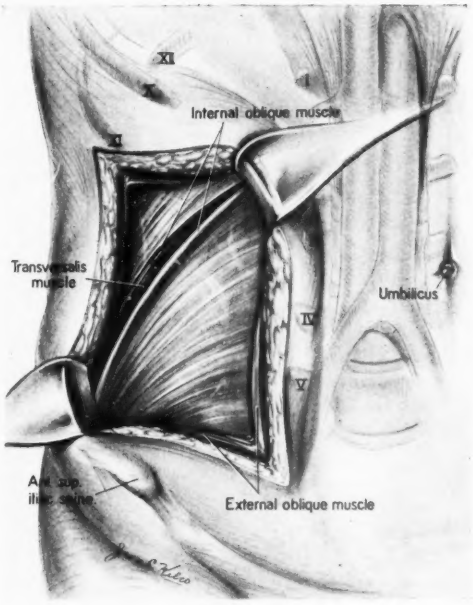

Fig. 4.

Fig. 3. Skin incision and anatomical relations.

Fig. 4. The external oblique muscle and aponeurosis have been split for the full length of the skin incision without undercutting the subcutaneous tissue. The internal oblique muscle has been exposed and split in the direction of its fibers in a line pointing to the top of the second lumbar vertebra and from the iliac crest to the rectus sheath. The underlying tranversalis muscle is thus exposed.

Fig. 5. The external oblique and internal oblique muscles have been retracted so as to expose the transversalis muscle. The latter has been split along its fibers for a distance of about 15 centimeters, the separation extending anteriorly to the lateral margin of the rectus sheath. The retroperitoneal fat is thus exposed.

the diaphragm, and caudad to the brim of the pelvis. Retractors are useless until this is completed. A special retractor devised by Royle or a similar wide retractor is then inserted, and the parietal peritoneum with the abdominal contents is retracted mesad. Another retractor may be used to draw the psoas muscle laterad, although this may not be necessary. A thin fascia covers the psoas muscle, great vessels, and sympathetic chain. This is opened and dissected free (Fig. 6).

On the left side the sympathetic chain is found on the bodies of the vertebræ, in the sulcus between the psoas muscle and the aorta. By moving the retractors caudad or cephalad the sympathetic chain can be exposed from the medial lumbocostal

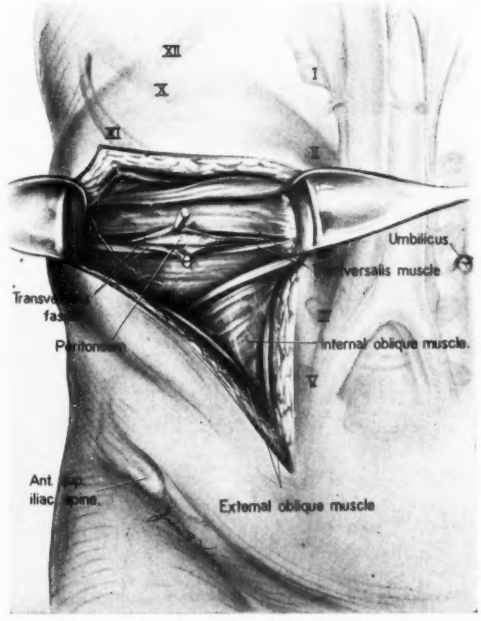

Fig. 5.

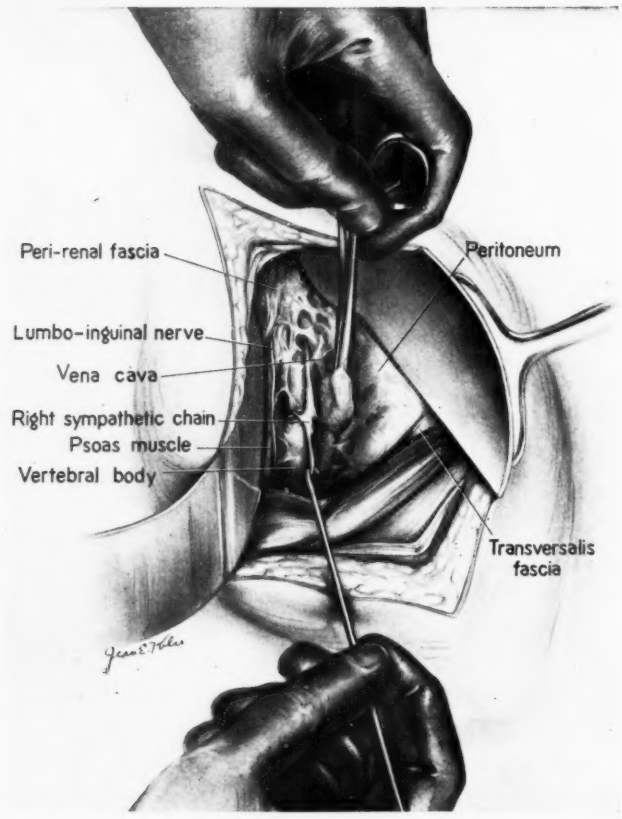

Fig. 6. The retroperitoneal tissues have been separated from the underlying muscles with the hand. The Royle retractor is in place, drawing the intact parietal peritoneum mesad. The vena cava has been freed of its surrounding connective tissue, mobilized, and drawn mesad with the help of a mounted gauze sponge. The sympathetic chain has been thus exposed and is shown drawn taut by a blunt hook. At this level one sees the third ganglion with the rami directed transverseiy or caudad.

arch (Fig. 7) to the brim of the pelvis. Royle uses a special psoas retractor with blunt teeth. If this is employed one must be careful to avoid tearing the muscle, as this may result in troublesome bleeding.

On the right side the vena cava usually lies directly over the sympathetic chain. It is best to mobilize carefully this vessel over its entire abdominal extent before beginning the sympathectomy. This may be done with a mounted sponge. It is not wise to draw it aside with the Royle retractor for fear of injury to it or its branches. As the vena cava is drawn mesad, the chain and rami are exposed. The ganglionated chain is intimately bound to the fascia covering the vertebræ. It must be freed from its attachments using fairly forceful dissection. The chain is tough and taut, one of its most characteristic physical attributes. Small lumbar veins and arteries usually accompany the rami and pass anterior to it. These need not be divided. The chain may be drawn under them as the rami are severed, or the rami may be cut if necessary to facilitate its removal. Very little bleeding is encountered. If, however, troublesome bleeding occurs in the depths and ligature is difficult, silver clips may be utilized. These have stood the author in good stead on several occasions.

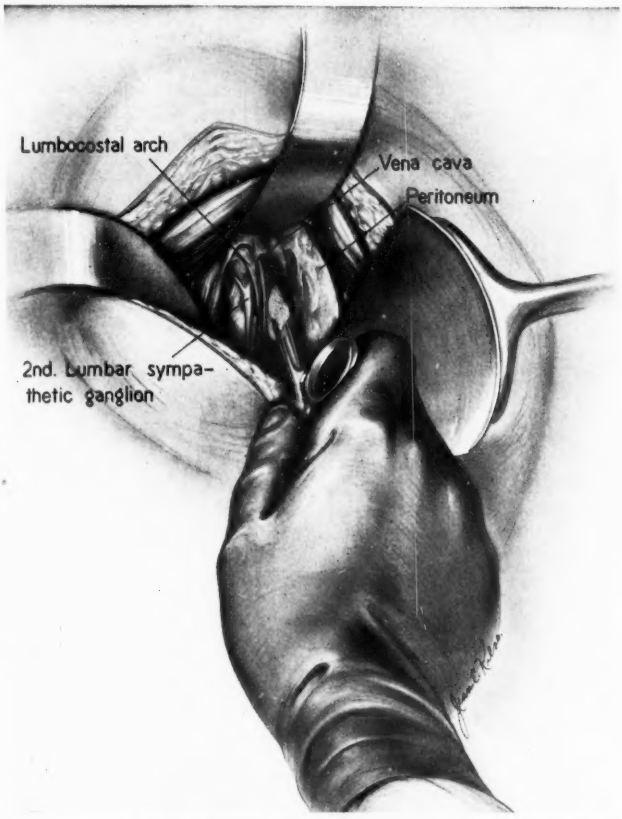

Fig. 7. The retractors have been moved cephalad. Another retractor, Deaver type, has been placed so as to expose the upper limit of the chain as it disappears under the medial lumbocostal arch. The vena cava has been further mobilized and held mesad. The highest ganglion seen is the second. The first ganglion lies under the insertion of the crura. Note that the rami connected to the second ganglion are directed sharply cephalad, a fact which allows of its easy identification.

In identifying the sympathetic trunk we must be careful to distinguish it from the lumbar lymphatic vessels. An unusually low formation of the receptaculum chyli may make definition and mobilization of the trunk difficult. Small lumbar arteries must not be confused with rami communicantes. The abdominal trunk should be removed from above the second to below the fourth ganglion, severing all the rami communicantes. The arrangement of the ganglia is sometimes variable. Two adjacent ganglia may be fused, or ganglia may be missing. The identification of the ganglia depends primarily on which rami are attached to them rather than on their position in relation to the vertebræ. In this way fusion of two ganglia may definitely be diagnosed. The second ganglion may be identified by the fact that its rami are directed sharply cephalad, whereas the rami of the third and fourth ganglia are directed caudad or transversely (3) (Fig. 7).

Step 6. After the ganglionectomy and trunk resection the retractors are held in place while the entire field is washed thoroughly with warm saline solution. A large number of fat particles will float in the solution and should be removed. Any bleeding points are ligated carefully. The retractors are then removed and the tissues allowed to fall together. It is unnecessary to change the

position of the patient. The muscles come nearly to approximation. Closure is effected in layers, suturing each with interrupted fine black silk.

On September 24, 1934, the author first performed completely muscle-splitting extraperitoneal lumbar ganglionectomy by a technique which had been previously developed on fresh cadavers. The position of the patient and the site of the incision are shown in Figure 1. This approach had several disadvantages. It was sometimes very difficult to insert the Royle retractor because of inadequate space between the costal margin and the iliac crest. Harsh retraction was necessary to expose the chain, especially at the lumbocostal arch, and especially in subjects with thick, well developed muscles. Accumulation of serum between the subcutaneous tissues and the external oblique muscle was common.

In an attempt to eliminate these disadvantages, a transverse incision was developed on fresh cadavers and performed on the live subject for the first time on March 14, 1935. The position of the patient and direction of the incision are shown in Figure 1. A similar technique was later described by Flothow. This allowed the transversalis muscle to be split more anteriorly and gave more space for the insertion of retractors, but harsh retraction was still necessary, and satisfactory exposure was difficult to obtain. It was also felt that the wide undercutting of the subcutaneous tissues was undesirable, predisposing to delayed healing.

The final technique which is here recommended, eliminates to a great extent the defects of the previous approaches. Undercutting of the subcutaneous tissues is unnecessary, and the retractors are readily placed. By this method quick, easy, and satisfactory exposure to the lumbar sympathetic chain is obtained without harsh retraction. No somatic nerves are divided. There is no shock. Closure is easily accomplished without tension, and the chances for the occurrence of postoperative hernia are minimal. The operator may do the second side, if he so decides, with very little disturbance of the operative field or the personnel. The postoperative course is smooth; opiates are usually unnecessary after the first or second day. The patient may be allowed up on the third day, and may leave the hospital on the fourth or fifth day if there is no contra-indication elsewhere.

SUMMARY

The author describes in detail a completely muscle-splitting extraperitoneal approach to the lumbar sympathetic chain and discusses the advantage of this technique over the muscle-transecting approach, and over previous muscle-splitting approaches. The operation eliminates the transecting of muscles, and the undercutting of skin and subcutaneous tissues; gives quick, easy, and excellent exposure of the lumbar sympathetic chain over its entire extent without harsh retraction; and allows closure without tension. There is no shock, and wounds heal *per primam*. The patient may be discharged from the hospital on the fourth or fifth day after operation.

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EDITORIALS

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THE SURGICAL TREATMENT OF HYPERTENSION

THE treatment of essential hypertension by various operative procedures represents a new excursion of surgery in therapy. It is highly important for the welfare of the patient and for the science of surgery that these newer departures, which often involve considerable risk, be taken only after most careful consideration and that they be re-examined from time to time as new evidence appears either from the laboratory or the clinic. The methods employed have been designed to accomplish a removal of vasomotor control over a large share of the vascular bed and a diminution in the rate of secretion of epinephrine. The recent discovery by Goldblatt, Lynch, Hanzal, and Summerville[1] that a long continued hypertension can be produced in dogs by the application of a specially devised clamp which constricts the renal arteries has made the problem susceptible of experimental approach. The demonstration that this hypertension may occur even if the kidneys have been previously denervated (Irvine[2]), or the splanchnic nerves excised (Goldblatt[3]) indicates that a humoral mechanism is involved. A rational basis for splanchnicectomy and allied procedures would seem to depend upon the possibility that the unknown chemical implicated in hypertension acts on the vasoconstrictor centers. Palliation through removal of normal vasoconstrictor impulses would be expected to be short lived since Phemister and Grimson[4] found that the fall of blood pressure which follows complete sympathectomy in the dog persists for only a short time and in all cases there is a return to normal within a year. Goldblatt and his associates[5] report furthermore that the bilateral excision of the entire thoracic portion of the splanchnic nerves and the lower four dorsal sympathetic ganglia neither prevents the development of hypertension in dogs by their method nor cures it after it has been produced.

The operations designed to decrease the secretion of epinephrine have consisted in bilateral adrenal denervation and partial or subtotal adrenalectomy. The thought behind these procedures is doubtless that the hypertension is due to the constant secretion of an excessive amount of epinephrine into the circulation. Attempts to demonstrate a state of hyperadrenalemia in cases of hypertension by the direct method of analysis of the blood have, however, been usually unsuccessful. If one surveys the literature it becomes readily

[1]Goldblatt, Harry, Lynch, J., Hanzal, R. F., and Summerville, W. W. Exper. Med., 1934, 59: 347.

[2]Page, I. H. Am. J. Physiol., 1935, 112: 163.
[3]Goldblatt Harry. Proc. Ass. Path. & Bacteriol., 1936, Apr. 9-10.
[4]Grimson, K. S. Proc. Soc. Exper. Biol. & Med. 1930, 34: 235.
[5]Goldblatt, Harry, Gross, J., and Hanzal, R. F. J. Exper. Med. 1937 65: 233.

apparent that negative results balance positive findings and in the majority the methods used are entirely inadequate. The indirect evidence supporting the possibility of hyperadrenalemia as the causative factor in hypertension is more substantial. The syndrome associated with chromaffin cell tumors is now well established and the literature in this field has been recently reviewed by Belt and Powell[1] and Coller, Field, and Durant.[2] Patients with these tumors have been found to display a paroxysmal hypertension together with other symptoms such as pallor, profuse sweating, dyspnea, headache, precordial oppression, bradycardia, nausea and vomiting. The origin of these tumors from the adrenal medulla, their histological appearance and brown staining after chromate fixation, the isolation from them of large amounts of epinephrine, and the similarity of the symptoms of the paroxysmal attack with those produced by an injection of epinephrine suggest that a sudden excretion of adrenalin is the proximal cause of the hypertension.

Qualified opinion with respect to the function of the adrenal medulla is still far from agreement, and this in spite of an enormous amount of careful experimental work. The tonus theory assumes that there occurs a steady and continuous secretion of epinephrine into the circulation in amounts sufficient to provide a minimal but constant stimulation of sympathetic nerve endings. As a result of this action on the vasoconstrictor nerves it is assumed that epinephrine thus plays a rôle in the maintenance of the normal blood pressure. A serious objection to the tonus theory arises from the fact that cats, dogs, and monkeys have been found to live indefinitely in good health after removal of one adrenal and complete denervation of the other, an operation which reduces the output of epinephrine to an undetectable amount. Furthermore dogs and cats have been kept alive and in good condition after bilateral adrenalectomy by the administration of cortical extracts free from epinephrine. This evidence would prove that the adrenal medulla and its product epinephrine performed no significant function were it not for the fact that a considerable amount of extra-adrenal chromaffin tissue exists in various parts of the body. The demonstration of epinephrine in paragangliomas arising from this tissue suggests that it has a functional capacity similar to the adrenal medulla. A frequently stated objection to the tonus theory, namely that minimum effective doses of epinephrine cause a fall rather than an increase in blood pressure and that when the dose is raised to a sufficient degree to produce pressor effects inhibition of the gastro-intestinal tract results, has been recently found to be untenable. The depressor effect of small doses of epinephrine was demonstrated by C. A. Dragstedt, Wightman, and Huffman[3] to be due to the anesthesia and that if measurements were made on the normal unanesthetized dog, the minimal effective dose of epinephrine on sustained intravenous injection caused an increase in blood pressure without inhibition of gastro-intestinal motility. In recent experiments C. A. Dragstedt[4] found that compatible suprarenal vein blood collected from one dog and reinjected into a second unanesthetized dog at the same rate at which it was collected produced a slight rise in blood pressure which was not secured by the injection of systemic blood. He concluded that the adrenals normally and constantly secrete epinephrine in amounts sufficient to modify the vascular bed and that a slight augmentation of secretion might easily produce hemodynamic effects

[1]Belt, A. E., and Powell, T. O. Surg., Gynec. & Obst., 1934, 59: 9.
[2]Coller, F. A., Field, H., and Durant, T. M. Arch. Surg., 1934, 28: 1136.

[3]Dragstedt, C. A., Wightman, A. H., and Huffman, J. W Am Physiol., 1928, 84: 307.
[4]Dragstedt, C. A. J. Am. M. Ass., 1928, 91: 1035.

These observations provide very strong support to the tonus theory of medullo-adrenal function and at the same time remove some of the more formidable objections to the view that a hypersecretion of epinephrine may be the cause of hypertension. A more or less critical test of the theory has been recently made in the writer's laboratory.[1] A sustained hypertension for periods up to 2 weeks was produced in normal dogs by the continuous intravenous injection of epinephrine. The amount required, however, was sufficient to cause death from the other systemic effects of the hormone of which the inhibition of motility of the gastro-intestinal tract and the derangement in carbohydrate metabolism were probably the most important. Such findings make it appear very unlikely that long continued hypertension in man, in which the other systemic effects of epinephrine are usually absent, will be found to be due to hyperadrenalemia. The associated symptoms in cases of chromaffin cell tumors with paroxysmal hypertension have likewise been so severe that it does not seem possible that a patient could survive the persistence of so serious an attack. For the moment then it seems wise that there be no widespread adoption of these proposed surgical procedures for the treatment of hypertension and that it be incumbent upon those who now carry them out to make careful and long continued postoperative studies which may be considered in the light of the natural history of the disease. LESTER R. DRAGSTEDT.

CANCER OF THE BREAST

THERE is an increasing murmur of disappointment over the results of our campaign to control cancer of the breast. We have not decreased the death rate of the disease, and it has become doubtful that we can do so, in the near future, by any means now at our disposal. The results of our present day treatment are described as no better than Halsted obtained 40 years ago. The time has come to review all the facts, both favorable and unfavorable to our management of breast cancer. We need a restoration of faith in our well established methods of treatment. The following considerations do this, even though they emphasize the unfavorable aspects of the situation.

The death rate from cancer of the breast in the Registration Area of the United States in 1903 was 5.5 per 100,000; in 1933 it was 9.9. Were it not for the fact that vital statistics were kept rather carelessly 20 years ago, these figures would seem to show that the death rate from breast cancer has nearly doubled in that time. Cancer of the breast is more easily recognized at death than any other common form of cancer. The statistics on its frequency are therefore likely to be trustworthy. There is no escape from the conclusion that it is at least as common a cause of death today as it was 2 decades ago, despite the intensive fight that has been waged against it. This does not of necessity mean that the fight has done no good at all—only that its results are not yet shown by the mortality rate. However, if the same criteria as to the success of measures designed to control an infectious disease are applied to the success of the measures heretofore used to control breast cancer, they indicate that the latter have accomplished next to nothing.

The radical operation for operable cancer of the breast in well known clinics gives a percentage of from 32 to 39 of 5 year cures. As Adair states, reports giving percentages much higher than these are to be looked on with suspicion. There seems to be no hope of improving the radical operation or of increasing its extent.

[1] Prohaska, John Van, Harms, H., and Dragstedt, L. R. (unpublished experiments).

Serious attempts to treat breast cancer by irradiation have been made for perhaps 20 years. The results of this treatment are not so well known as those of operation. The technique has not been standardized. There is difference of opinion as to the relative value of high voltage x-ray and radium treatment. Breast cancer appears to be radioresistant and requires a dosage so heavy as to produce ulceration in some cases. Many roentgenologists lack the courage to give it. Adair states that "irradiation 'cures' are produced by locking up the disease in dense fibrous tissue, and starving the disease process by endarteritis, and the direct insult to the cancer cell which is produced by the rays." He reports 12 five year survivals of a series of 37 operable cases treated by irradiation methods only, a percentage of 36.3. This is one of the very few carefully studied series of cases so treated which I have been able to find. It is probable that these patients received about as good treatment as is possible in the present state of knowledge, and that the 36.3 per cent of 5 year cures is about the best that can be expected from irradiation alone. The same author reports 40.6 per cent of 5 year cures among 137 cases treated by combined operation and irradiation.

It is significant that the percentage of 5 year cures obtained by irradiation as the sole method of treatment is about the same as that obtained by operation alone. It is also significant that very few authorities on irradiation advocate it for operable cases except in combination with the radical operation. The writer has seen cases in which irradiation seemed to hasten the spread of the growth; also cases in which it caused a rapid disappearance of metastatic nodules. In nearly all cases irradiation will alleviate the pain of spinal metastases.

It is the usual experience of surgeons nowadays that their patients die with no, or comparatively insignificant, recurrences in the field of operation. They die of internal metastases. Primary tumors, found with difficulty at autopsy, may produce massive and widespread metastases. Metastases may be found 15, 20, even 43 years after operation. Absolute proof of cure can be obtained only by autopsy. Some growths cause death within a period of 3 months.

Daland has shown that of 100 cases of untreated cancer of the breast, 26 were living after 5 years. The term "early case" is liable to be a misnomer. With improved methods and a diligent search we have been able to find axillary metastases in nearly all our apparently early cases. From all this it is evident that the vital characteristics of cancer of the breast are extremely variable. We must agree to the dictum that the fate of the patient is sealed before she comes to operation. Neither by operation nor by irradiation can we hope to destroy more than the local growth and its regional ramifications. Early operation is better than late operation, but early operation is not so much better as we once thought it to be.

The foregoing facts must sober our thoughts regarding breast cancer, but they should not in the least destroy faith in our treatment of it. They warrant the following conclusions:

1. That radical operation combined with irradiation or alone will in nearly all cases rid the patient of the horror of the local growth. We now seldom see foul ulcerating tumors fixed to or invading the chest wall. Even if treatment produced no permanent cures at all, it would still be a great blessing.

2. That in at least 33 per cent of all cases the vital characteristics of the growth so limit it that fairly early operation will be followed by survival for 5 years or longer.

They do not justify half hearted or perfunctory treatment, which we know by ample experience is worse than no treatment at all. The results of treating breast cancer are as good as those obtained by treating cancer of the cervix, and infinitely better than those obtained by treating cancer of the stomach. We can hope for some improvement of our results from better methods of irradiation, but for any great improvement we must await fundamental scientific discoveries.

W. D. GATCH.

MASTER SURGEONS OF AMERICA

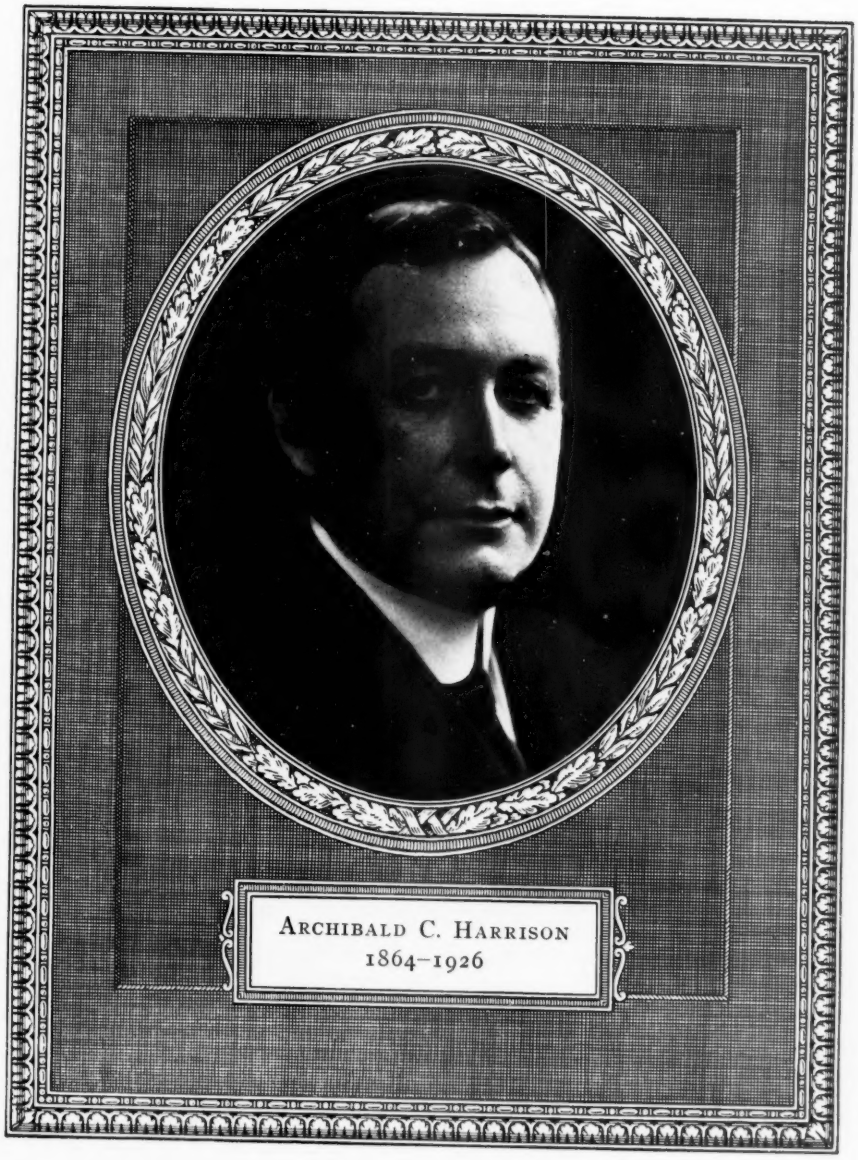
ARCHIBALD CUNNINGHAM HARRISON

BORN near Richmond, Virginia, January 6, 1864, Dr. Harrison was fortunate in his parents and lineage, but unfortunate in the time and location of his birth, his mother at the time having been forced to leave her home because of Civil War battles in the neighborhood. Like many of his contemporaries from the South, the Civil War and Reconstruction Period prevented him from having the advantages he otherwise would have had. This is made the more easily understood by a visit to his boyhood home which, at one time, was occupied by Union troops and which is in a neighborhood where there was much heavy fighting. Here Stuart made some of his most dashing maneuvers and a few miles distant stand the handsome and famous Seven Pines.

On his father's side he was descended from a long line of distinguished ancestors, including Benjamin Harrison, Councillor Robert ("King") Carter, Archibald Cary, and the original William Randolph. His mother was the daughter of Benjamin Watkins Leigh, noted lawyer and political figure of his time, and Julia Wickham, granddaughter of John Wickham, the lawyer who defended Aaron Burr. Dr. Harrison's father was Dr. Thomas Randolph Harrison, a physician of varied knowledge, great resource, and with many of the characteristics later seen in his distinguished son. Though a country doctor without facilities, he was remarkably successful in surgery, and it was his enthusiasm and success that influenced the son to be a surgeon. The son also inherited the father's love for natural history.

Julia Wickham Leigh, his mother, was a woman of fine force of character and known for her large fund of information, the result of unusually wide reading.

Dr. Harrison's early education was obtained in a log cabin public school, a private school near his home, one year in a boarding school at Winchester, Kentucky, and one year at Hanover Academy, Virginia. His medical education was obtained at the University of Virginia and the University of Maryland. He was graduated at the latter school in 1887. Upon graduation, he was appointed interne at Bay View Hospital (now The City Hospitals) and when the Johns Hopkins Medical School opened, he worked for a short time in its dispensary under Dr. Halsted. Though this connection was brief, it aroused in him an admiration for Dr. Halsted and his work that constantly increased, was a constant inspiration, and undoubtedly influenced his conception of surgery as did his work under Dr. L. McLane Tiffany.



ARCHIBALD C. HARRISON
1864–1926

Feeling that he had to obtain a living wage quicker than he saw opportunity of doing in Baltimore, in 1890 he went to Meyersdale, Pennsylvania, and did general practice there until 1898. During this period, he did all the surgery that came to his hand, but ever with a desire to get back to Baltimore and a larger field with greater opportunities for development. Finally the temptation could be withstood no longer and he returned to start afresh at the age of 34 years. In 1892, Dr. Harrison married Anna Warfield of Howard County, Maryland. By this marriage, there were three daughters. The relationship that existed in this happy family was an ideal one. In the working world, his hands were not always gloved, but in his home, he was the ultimate in gentleness, consideration, and good humor.

Promptly after his return to Baltimore, Dr. Harrison took up the study of anatomy, and night after night worked in the dissecting room at the College of Physicians and Surgeons until two or three o'clock in the morning. His industry and his knowledge of anatomy soon obtained for him the position of an assistant demonstrator, and in a few years it was recognized that he had mastered anatomy as few surgeons do.

In 1901, he was made demonstrator of anatomy, and in 1902 was put upon the visiting staffs of surgeons of Mercy and Bay View Hospitals; thus giving him also some clinical opportunities. In 1903, he was made associate professor of surgery and anatomy. In 1908, he was made professor of anatomy and clinical surgery, and in 1913, professor of surgery. In 1915, the College of Physicians and Surgeons combined with the University of Maryland and he retained his last title until his death. In 1908, he was made a visiting surgeon to St. Joseph's Hospital and after this, there followed appointments to the staffs of the Church Home and Infirmary, the Hospital for the Women of Maryland, the Baltimore Eye, Ear and Throat Hospital, and the South Baltimore General Hospital.

Dr. Harrison was peculiarly fitted by nature to be a surgeon. His appearance, his calmness, his carefulness, thoroughness, resource, courage, and judgment were a foundation upon which he built by hard work, careful preparation, and deep thought.

The excellent courses given in the primary subjects of medicine at the University of Virginia, particularly in anatomy, the clinical work he saw at the University of Maryland and Bay View, the miscellaneous work he had in general practice, his training in the dissecting room, the clinical facilities he was given, were all made the most of and were seed sown upon fertile soil; so that when his larger opportunity came, it found him prepared with an excellent ground work.

Dr. Harrison's knowledge of anatomy plus his calm, deliberate manner of operating and his perfect technique, enabled him to do surgery with a precision and exactness rarely equalled. The ordinary operations that he did repeatedly were done splendidly—one feels like saying perfectly—but it was in the extraor-

dinary procedures that he shone most brilliantly. Given a condition for which no definite operative procedure was described, he took pleasure in thinking out a method and line of approach and would carry through the operation, nearly always, just as he had planned it. In his vigorous years, he seemed to revel in difficult operations and particularly in those requiring careful anatomical dissection.

As a surgeon, he deserves the highest rank. As a diagnostician, he shone not only in surgical conditions, but medical conditions as well, making his advice particularly valuable in puzzling, borderline cases. A large part of his diagnostic ability was due to his unusual skill in obtaining the patient's history. As an operator he had few equals—the same thoroughness and care observed in the diagnosis were used here. He admired the painstaking, deliberate type of surgeon and was bitter against the operator who tried to be rapid, at the sacrifice of technique and a regard for tissues.

Perhaps Dr. Harrison's greatest service to his profession and the public was his firm stand for this type of surgery. Who can say how far this influence is felt? There are surgeons taught by him as students and internes practicing in all parts of the Union. He had a very high ideal in surgery and he came nearer to his ideal than falls to the lot of most men. The exactness and neatness of his work, plus the beautiful exposures and careful dissections, made his operating taxing and tiring, but he lived up to his ideal or deviated from it only when speed was absolutely essential. Then, contrary to the opinion of many, he could work quite rapidly.

In certain types of work, for instance, bone surgery or large difficult dissections, like tumors of the neck, jaw or tongue, and many other conditions, the writer has not seen his superior in any clinic. In postoperative treatment he gave his time unsparingly—was skillful and resourceful.

Dr. Harrison had, in a remarkable degree, the power to separate the wheat from the chaff in surgical measures and could almost unfailingly pick out among the new suggestions, the ones that would last and the ones that would be discarded. He was not a research worker, but his ability to sift confusing and complex evidence and to arrive at a clear, concrete verdict was well known and his advice and judgment were constantly sought by surgeons and practitioners and frequently by lawyers who had medicolegal problems. By a large group of younger men, he was consulted freely regarding all manner of problems, and his advice was always logical and clear. As in the home, so with his patients, he was gentleness itself—particularly with women and children and the very ill, but woe to the man who was a coward or a malingerer!

It is a pleasure to remember the many pleasing and admirable characteristics of Dr. Harrison—his personal attractiveness, his honesty and integrity, his courage, his humor, his forthrightness (and, upon justification, his ferociousness).

As a man he met things squarely, and of those who did not, he was, particularly in his later years, somewhat critical. When this is said, the indictment of faults is complete, and it might be said in extenuation that many of his estimates were, in due time, found to be true. His criticisms, however, were limited to man. He had a great love of animals and he knew a great deal about them, as he did also about trees and about birds. He had unlimited admiration for nature and for her laws.

His achievements are the more to be admired when it is realized that his surgical career was really a short one. He returned to Baltimore in 1898. It necessarily took him a few years to obtain a foothold and his work, like that of many others, was seriously interrupted by going overseas in 1917. After his return in 1918, he accomplished a great deal, but he knew his cardiac condition had to be favored and he did not exert himself as he had previously done.

The period of 1906 to 1917 was the flood tide of his career. During this time, he accomplished an enormous amount of work, but no matter how rushed he was, how many operations he had posted, each one had to be done as though it were the only one posted that day.

Though it was always difficult to persuade him to write, in these years, he appeared rather frequently before medical organizations, and in 1906 was elected president of the Baltimore City Medical Society and in 1913 was made president of the Medical and Chirurgical Faculty of Maryland.

When America entered the war, Dr. Harrison promptly offered his services by going to Washington and asking to be allowed to organize a small mobile unit of some type. This offer was refused and the refusal led him to make some statements to the then Chief of the Red Cross that made the writer, who was present, feel rather uneasy, but apparently no offense was taken, for he was urged to organize a Base Hospital which he, at the time, thought could not be done. It is another instance of the clearness of his judgment that the type of unit he wanted to organize was eventually found to be essential and Base Hospitals were largely broken up to form such teams. Later, the University of Maryland Unit was organized as Base Hospital No. 42 with Dr. Harrison as director. At this time he was given the rank of Major, later he was made a Lieutenant Colonel and after the War he entered the Reserve as a Colonel. Organizing and commanding Base Hospital No. 42 and doing such excellent work abroad was considered by his friends as being an outstanding achievement, but he rarely referred to it and never once mentioned any hardships or stress that he must have undergone. When he found himself in failing health, he never intimated that the War had anything to do with it, except to say he thought an attack of influenza, suffered while in France, had done him harm. After he returned to this country he received a citation from General Pershing for "especially meritorious and conspicuous service at Base Hospital No. 42, France."

Dr. Harrison was a strikingly handsome man, of a large upstanding figure and a commanding presence. In his youth and early manhood, he was very athletic, being a good swimmer, a crack shot and so successful in amateur baseball that he was offered a position on a professional team. Possessing a keen sense of humor, being quick at repartee, a good story teller and having a great fund of accurate information, made him a most entertaining and instructive conversationalist. He was a great lover of nature and no recreation was so pleasing to him as roaming through the woods or fields, observing the birds, trees, and animals about which he knew so much.

Though always having the desire for it, extensive general reading was to a large extent denied him in the years when he was developing himself as a surgeon, but in later years, this pleasure came to him in full measure. He read discriminatingly, extensively, and in the same manner that he had read surgery, slowly, carefully, with deep insight and by no means always accepting the author's conclusions.

His father, having lived to the age of 81 and his mother to the age of 87, the life expectancy of Dr. Harrison should have been more than the allotted three score years and ten, but his tragic death occurred a few days after the completion of his sixty-second year. In his passing, his immediate family and large family connection lost their idol. The surgical profession lost a clear thinker, a lucid teacher, a master surgeon.

He, "in every storm of life was oak and rock, but in the sunshine, he was vine and flower."

WALTER D. WISE.

LANDMARKS IN SURGERY

TROUSSEAU AND THORACENTESIS

JEROME R. HEAD, A.M., M.D., Chicago, Illinois

IN 1863 in his "Clinique Médicale de l'Hôtel Dieu," Armand Trousseau summed up his contributions to the operation of thoracentesis in a passage which is a unique and dignified expression of man's desire to have contributed permanently to the work to which he has devoted himself.

"One will render me, I hope, this justice," he wrote, "that I rarely speak of myself and that for my part I generally attach little importance to questions of priority. I may then once in passing give to myself the credit due me in the matter of paracentesis of the chest. I make no pretension to having conceived it; I have invented no special instrument to facilitate the operation; I have not advised any operative procedure which was not already perfectly well known; but I believe that I was, if not the first, at least one of the first, to have formulated the necessity of paracentesis of pleurisies with excessive effusion. I established with precision, perhaps with more precision than any one before me, the indications; and finally, I believe that I popularized a method which has now been generally adopted. For these reasons I consider that I have contributed somewhat to the progress of the treatment of pleurisy."

Armand Trousseau
1801–1867

Trousseau read his first communication on paracentesis for pleurisy with excessive effusion before the academy of medicine of Paris in 1843, and the year following cited additional cases.

Trousseau's rôle in the development was that of the clinician and the popularizer. He stressed the fact that pleurisy with excessive effusion was frequently the cause of sudden death from pulmonary embolism and that chronic persistent effusions occasionally left the lung permanently crippled and the thorax distorted. He noted that dyspnea was a misleading symptom, frequently being absent in the presence of large and dangerous accumulations. He said that the entrance of air was not to be feared, nor the rapid withdrawal of large amounts of fluid. He did not realize that he could safely do the latter only because he permitted air to equalize the pressure.

The indications for thoracentesis came gradually to be recognized, and then, as is so often the case, to be extended and abused.

Gradually the pendulum swung back. Aspiration today is done diagnostically or only for excessive effusions or those unduly chronic. Sudden death from embolism, and calcification of the pleura, are the complications it can and should prevent. Recognition of the facts that most simple pleurisies are tuberculous and that collapse of the lungs favors the healing of the basic pulmonary lesion has led men to regard the effusion as of therapeutic value and in some instances, when the causative pulmonary tuberculosis is at all advanced, to prolong the collapse which the fluid has initiated by replacing it with air.

During the middle decades of the 19th century, Armand Trousseau was the foremost teacher, clinician, and consultant in Paris. Paris and Dublin were then the medical centers of the world. At a time when the theory and practice of medicine were undergoing revolutionary changes, he was the chief advocate of the new order and his clinics at l'Hôtel Dieu, attended by students and physicians from all nations, became a fountain head whence the best and latest in medical thought was disseminated throughout the world. And yet this man whose career was so brilliant, who in his own right won and filled the highest position in his profession, cannot be considered—in fact never considered himself—as more or greater than the pupil of a greater man. Nowhere in medical literature is there an example of a more ideal relationship between master and pupil than was that between Bretonneau and his disciples, Trousseau and Velpeau.

Much that men do is done to justify the expectations of those whom they love and respect, and Bretonneau, one of the truly great physicians, had the

The Figure of an actuall cautery with its plate fit to be used in a Pleurisie.

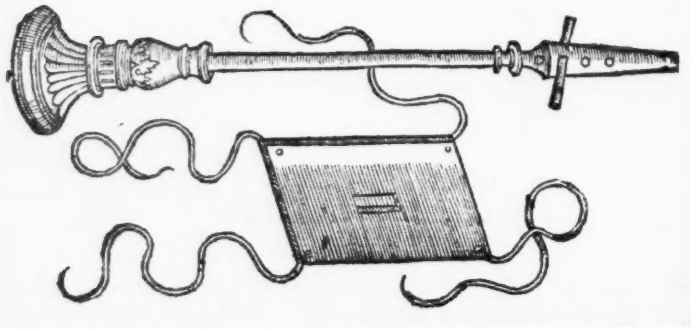


Fig. 2. Instrument.

rare quality of inspiring such devotion. Throughout his life Trousseau lived to justify the hopes this man had for him, writing to him regularly of his work, plans, hopes, problems, and in his clinics preaching his doctrines and popularizing his achievements.

Trousseau's first meeting with Bretonneau determined the course of his subsequent career. At the age of twenty, having completed his studies at the Lycée d'Orléans and the College of Lyons, he had attained the position of professor of rhetoric at the College of Chateauroux. Shortly after receiving this appointment he chanced to meet Bretonneau at the home of a friend. A mutual sympathy and appreciation must immediately have been discovered, for at the end of their first conversation the older man urged Trousseau to abandon teaching and study medicine. Trousseau followed the advice and the next two years spent on Bretonneau's service at Tours. "At this time," writes Gomez, "when Bretonneau by his studies had already arrived at an understanding of diphtheria and typhoid fever, he became his favorite pupil, the assistant in his work, the depository of his hopes, the witness of his success. Trousseau filled himself with the ideas of his master, and assimilated his doctrines; and it was these which he carried with him to Paris and which, presented with his natural eloquence and communicative ardor, revolutionized medical thought, and were the source of his reputation and of the originality of his teachings."

In 1825 Trousseau proceeded to Paris to continue his studies and to take his examinations for the doctorate. Having passed these and completed his thesis he wrote to Bretonneau, "I received the most flattering compliments from M. Recamier and M. Guersant, and I trust, therefore, that I have shown myself not less worthy of you than Velpeau and Cottereau." At this period, as throughout his life, his own success seemed important chiefly because it pleased and justified his master.

For every medical student the years following graduation are the most difficult and important. They were for Trousseau. He lacked money to continue his studies and was faced with the important problem of choosing a location for practice and deciding on the direction of his career. Velpeau persuaded him to take the examinations for admission to the faculty. It was a question of remaining in Paris and following the hard road of ambition or of returning to Tours and its easier and more pleasant ways. He wrote to Bretonneau, "If I am turned down, perhaps it will be for the best; if I am chosen perhaps that will be even better. The road of ambition being opened to me, I shall hurl myself into it with fury; and in spite of all obstacles it may be that I shall arrive. But if the door of the school is closed to me I shall consider myself quite happy to return to the depths of my province and there pass more good moments in six months than in ten years in this more brilliant theatre."

He finally decided that whether he was received or not, he would return to Tours. Bretonneau wrote to him, "What madness has taken possession of you, to bury yourself in this hospital when so fair and noble a career is open to you?" To this Trousseau replied, "I see it all clearly. I shall be appointed an *agrégé*, I shall sacrifice all to my reputation, to my advancement, and in fifteen years I shall be one of the twenty-two professors of our faculty. I shall be forty years old; my life three-fourths used; I shall know nothing of medicine and shall begin to acquire a clientele. I shall be quite satisfied and quite glorious. And my happiness, my dear master? You smile? What difference does that make?"

At Trousseau's continued solicitations Bretonneau secured for him the appointment as a surgeon at the hospital of Tours. And then, when all was apparently decided, Trousseau passed his examination and determined to remain in Paris. Bretonneau was irritated and hurt, "Permit me," he wrote, "A reflection

which is authorized by the paternal affection which I bear you and by my experience of life; the most important part of a man, that which is of the most intrinsic value, is neither his ability, his knowledge, or his talent; it is his character."

This was in 1826. The struggles that Trousseau had anticipated in Paris became real and it was not until 1839 when he was thirty-eight years old, that he finally secured the chair of therapeutics. In 1852 he reached the goal of his ambition and was appointed chief of the Clinique Médicale de l'Hôtel Dieu. One can believe that the dissipation of his energies irked him and that at times he grew "tired of knocking at preferment's door." When he had finally arrived, as he felt certain that he would, he could still write to Bretonneau in the tone of his earliest letters, "as the years pass, my life arranges itself more and more unsatisfactorily and I am now hurled into a medical whirlpool which prevents me from being a physician. However much I wish to escape from the distractions of the rôle, I am caught in the gears and all passes. The compensations of self esteem and money are little in comparison to the ennui which it all causes me, and I realize that no escape is possible save one that is complete. Flight, paralysis or death—those are my three ports of refuge, and it is not gay—."

In 1863 he resigned from his position at l'Hôtel Dieu and again took the chair of therapeutics. In 1866 he relinquished this also. It is probable that he already felt the beginnings of his last illness, for on June 23, 1867, after a long and painful decline, he died of cancer of the stomach. Bretonneau had preceded him by only four years and Velpeau followed him in a few months.

Trousseau contributed greatly to the progress of medicine in the 19th century—not by his original contributions, for these were negligible—but by his persistent, impassioned, and successful advocacy of the new ideas of other men. Most of these he had obtained from Bretonneau; a few, like thoracentesis, he acquired elsewhere.

Had Trousseau returned to Tours instead of remaining in Paris, it is possible that he would have contributed originally to medicine and come nearer to realizing his true ambitions. The strife and distractions incident to winning preferment in a great center are rarely conducive to original thought. But be that as it may, his energy and talents were exactly suited to the rôle he chose. His enthusiasm, his courage, his gift of rhetoric combined to make him the popularizer par excellence, and it is as the disciple of Bretonneau and the advocate of the ideas of other men that he must be remembered. To say this is not to dispraise him. In all phases of human activity such men are important and indispensable, for were it not for their imagination in recognizing the good in the new work of others and their energy in demonstrating and proclaiming it, progress would be seriously delayed.

THE SURGEON'S LIBRARY

REVIEWS OF NEW BOOKS

THE technique of urography, the normal and all the abnormal conditions of the urinary tract, are covered in the manual on urological roentgenology by Wesson and Ruggles.[1] In order to develop a logical basis for the roentgenological findings, each condition is discussed briefly but concisely; with the excellent illustrations, such a scheme of discussion makes this a practical handbook.

The authors introduce a rather unique method of combined retrograde cystoscopy and ureteral catheterization with intravenous urography; after the ureteral catheters are passed, their ends are plugged, and the intravenous urographical material is administered and roentgenographical studies are made at stated intervals. If unsatisfactory plates are obtained, retrograde urography is executed. The authors recommend an absolute use of the gravity method for the injection of the upper urinary tract with media. They believe, as most urologists do, that retrograde urography is still more valuable than intravenous urography.

The chapter embodying a discussion and illustration of urogenital infections is particularly elucidating and outstanding; urinary tuberculosis is correctly given a most important place. Renal tumors afford the opportunity for an excellent discussion and display of roentgenological studies. Traumatism of the urinary tract and the principles which govern their roentgenological studies is expertly discussed; the authors have apparently had much experience with this group of urological patients.

This practical manual can be recommended to medical students and practitioners whole-heartedly. Most urologists would do well to read the book too.

WILLIAM J. BAKER.

A FAIRLY complete review of the modern stage of gynecological radiotherapy is given in a recent monograph[2] written by the radiologist of the Centre Anticancéreux in Bordeaux which is one of the greatest cancer centers in France.

After a brief chapter on the physics and biology of gynecological radiotherapy and of the most important clinical facts to be considered in its application, the radiation treatment of benign lesions of the female generative organs is discussed, including the treatment of functional disturbances. After a short chapter on the radiation treatment of inflammatory conditions of the female genital organs, the largest part of the remainder of the book is devoted to the treatment of malignant tumors. A final chapter deals with the radiation treatment of cancer of the breast.

For those who read French this book is a convenient guide for information as to the present conditions of the application of radium in the different diseases of the female genital organs, of their indications and limitations. Its tenor is inspired by the leading ideas of the French school, although the author also discusses some of the modern foreign methods and accomplishments.

Obviously, the best parts of this book are those based on the author's own experience and on the experience of the Paris school; and it would have been an advantage rather than a loss to the book if the author had limited himself to these parts. The choice of references to the methods of other authors in a book of this type cannot be complete in any case. This choice sometimes seems fairly arbitrary, in so far as it is too short in most instances for complete reference information and on the other hand it lessens somewhat the advantages of a purely subjective textbook.

The book is completely brought up to date. Sometimes one has the impression that it is too modern, in so far as it includes methods whose definite value is not yet definitely established.

In general this book gives a very good survey of the indications and limitations of radiation therapy in these conditions. Especially the discussion of the treatment of cancer of the uterus can be endorsed in every detail. It is valuable to have the scattered information of the results of radiation therapy of cancer of the cervix in leading radiologic clinics in their comparison to surgical results collected here in a convenient form. In addition to the value of this book as a convenient source of brief information about the questions related to gynecological radiotherapy, the possibility that it may advance the knowledge of the facts of the accomplishments of radiotherapy in these conditions greatly enhances its original worth. In no country are these facts well enough known and certainly not enough appreciated by many of the surgical gynecologists.

There is an extensive bibliography appended.

MAX CUTLER.

THE author, H. Jessen, dedicates his work[3] on cytology of the cerebrospinal fluid to Paul Ravaut whom he calls the "father of the cytology of the cerebrospinal fluid." The book is divided

[1] UROLOGICAL ROENTGENOLOGY; A MANUAL FOR STUDENTS AND PRACTITIONERS. By Miley B. Wesson, M.D., and Howard E. Ruggles, M.D. Philadelphia: Lea & Febiger, 1936.

[2] RADIOTHÉRAPIE GYNÉCOLOGIQUE; CURIE-ET ROENTGENTHÉRAPIE. By R. Mathey-Cornat. Paris: Masson et Cie., 1936.

[3] CYTOLOGIE DU LIQUIDE CÉPHALO-RACHIDIEN NORMAL CHEZ L'HOMME; MONOGRAPHIE CRITIQUE ET PRATIQUE. By H Jessen. Paris: Masson et Cie., 1936.

into three parts, morphology, enumeration, and cytophysiology. All discussion is limited to normal fluid. Jessen describes the methods of studying the cells, immediate or delayed, with or without centrifugation, or by precipitation in their natural state or after fixing and staining as in hematology, or by the "vital" or "supravital" methods. To study the cells in detail he recommends the Alzheimer, Ravaut, Forster, Cunningham-Kubie, Einstein-Ostertag, and the Fischer, Kafka, Jessen techniques, pointing out that all have defects and limitations. He concludes that in the cerebrospinal fluid one finds only mononuclear cells, polymorphonuclears, and that others are rare and accidental. The mononuclears consist of small round cells, large round cells, polygonal cells, and intermediary forms. The first type is preponderant in number. Jessen indicates that these cells undergo cytolysis *in vivo* as well as *in vitro*, the rate in any one individual varying. This explains the variability in reported counts.

To study the number of cells in the normal patient, the author uses large series, examining quantities of fluid in a Glaubermann chamber which contains a volume of 20 cubic millimeters. He points out the danger of gross error in smaller chambers and advises not coloring the fluid for the count, but adding formalin to preserve the cells (1 part to 19 parts of fluid to make a 5 per cent dilution). The author considers up to 5 cells per cubic millimeter as normal, 5 to 10 as suspicious, and over 10 as pathological.

As for the origin of the cells, he indicates that the fluid is principally a secretion from the cerebral ventricles and that there are few if any cells there. An admixture of cells occurs as the fluid descends the arachnoid sac. This is "easily understood" because the cerebrospinal cavity has a large surface, and is traversed by trabeculæ rich in cells. Conditions are optimum for an admixture of cells into the fluid as it passes downward. As indicated before, the cells are chiefly lymphocytes, although others may be epithelial cells or histiocytes. The author believes that the cells are accidental elements in the fluid and serve no physiological function. There is no normal "threshold" for these cells, the limit between the normal and a pathological pleocytosis being variable. Jessen warns that what may be normal for one, may be abnormal for another, despite the general rules, and that all the other findings, the Wassermann, protein studies, etc., must be considered before deciding that a given pleocytosis is significant.

In general it may be said that the author has offered little that is new except to emphasize certain cautions, especially as regards the importance of studying the formalin-fixed cells in a large chamber. Of value is a good review of the literature and a critical evaluation of the various methods of study of the cytology of the cerebrospinal fluid. An excellent bibliography on the subject of cerebrospinal fluid, comprising 20 pages, is appended to the volume.

BENJAMIN BOSHES.

WITH the recent increase in the clinical knowledge and surgical treatment of diseases of the thorax, there has developed a need on the part of both the physician and the surgeon for a more detailed consideration of thoracic anatomy than is afforded by general texts and atlases. *Le Thorax*,[1] by Hovelacque, Monod, and Evrard, meets this requirement. Besides being an excellently illustrated descriptive text, it presents adequate discussion of controversial theoretical points and of all variations from the normal. The illustrations, which are the most important and practical part of any work on anatomy, are in the best traditions of the art and are so numerous that there is scarcely an area that is not depicted from many angles. As a reference book it should be of constant service to the physician, the surgeon or the roentgenologist who is working in the field.

JEROME R. HEAD.

AN ADMIRABLE guide for undergraduates, house surgeons, and young graduates in practice is provided in *Operative Surgery*, by Miles and Wilkie.[2] In this, the second edition, the text has been brought up to date. With the aid of their coadjutors, Miles and Wilkie have presented a condensed and forceful picture of the present-day practice in the Edinburgh School. As each page contains the valued observations and advice of experienced and accomplished surgeons, it will also be read with interest and profit by more mature surgeons. While no pretense is made for completeness, all the more common operations are described. The 329 illustrations are graphic and informative. The short summaries of the regional anatomy are excellent indeed.

In such a worthwhile book as this, it would seem poor taste for the reviewer to pick out very minor points for adverse criticism. None the less it is to be hoped that the description of direct blood transfusion by metal cannula from donor to patient will be omitted from the next edition. The reviewer regretted not finding mention of the Orr treatment of osteomyelitis and was somewhat pained at the idea of giving calomel or castor oil on the third day after an abdominal operation.

Miles' and Wilkie's *Operative Surgery* is a useful and valuable book and can confidently be recommended.

FREDERICK CHRISTOPHER.

[1] LE THORAX; ANATOMIE MEDICO-CHIRURGICALE. By Pr. Hovelacque, Oliver Monod, and Henri Evrard. Paris: Librairie Maloine, 1937.

[2] OPERATIVE SURGERY. By Alexander Miles, M.D., LL.D., F.R.C.S. (Ed.), and D. P. D. Wilkie, M.D., F.R.C.S. (Ed. and Eng.). 2d ed. London: Oxford University Press, 1936.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

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A BRIEF OUTLINE OF MODERN TREATMENT OF FRACTURES. By H. Waldo Spiers, A.B., M.D. 2d ed. Baltimore: William Wood & Co., 1937.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

EUGENE H. POOL, New York, *President* FREDERIC A. BESLEY, Waukegan, *President-Elect*
VERNON C. DAVID, *Chairman;* MICHAEL L. MASON, *Secretary, Committee on Arrangements*

PRELIMINARY PROGRAM FOR THE 1937 CLINICAL CONGRESS IN CHICAGO

IN the following pages there appears a preliminary schedule of operative clinics and demonstrations at the hospitals and medical schools as prepared by the Committee on Arrangements for the twenty-seventh annual Clinical Congress of the American College of Surgeons to be held in Chicago, October 25–29. It will be noted that clinics are being arranged for the afternoon of Monday, October 25, and for the mornings and afternoons of each of the four following days. Published in tentative form at this time, the clinical program will be revised and amplified during the months preceding the Congress.

In addition to an ample and well-arranged schedule of operative clinics that will demonstrate the technique of a wide variety of surgical procedures, the Committee is arranging a series of demonstration clinics at the medical schools and in the larger hospitals for the presentation of work being done in many special fields such as neurosurgery, traumatic surgery, thoracic surgery, fractures, plastic surgery, cancer, orthopedics, genitourinary surgery, obstetrics and gynecology, physical therapy, roentgenology, etc.

The Committee expects to so correlate the program that the visiting surgeon may be assured of an opportunity to devote his time continuously, if he so wishes, to clinics dealing particularly with the special subjects in which he is most interested. For example, it is planned to arrange so that fracture clinics will be available each forenoon and afternoon during the Congress, and similarly clinics and demonstrations in many special subjects.

The surgeons of Chicago, under the leadership of a strong and representative Committee, expect to provide a program of clinics and demonstrations that will present a complete showing of the clinical activities in all departments of surgery in this great medical center.

The Committee is assured of the hearty cooperation of the clinicians at the five medical schools and more than fifty hospitals that will participate in the clinical program.

The Executive Committee in charge of arrangements is as follows:

VERNON C. DAVID, *Chairman*
MICHAEL L. MASON, *Secretary*
FRED L. ADAIR
RALPH B. BETTMAN
ALEXANDER BRUNSCHWIG
FREDERICK CHRISTOPHER
WARREN H. COLE
EDWARD L. COMPERE
JOHN S. COULTER
WILLIAM R. CUBBINS
HARRY CULVER
LOYAL DAVIS
GEORGE DETARNOWSKY
LESTER R. DRAGSTEDT
HARRY S. GRADLE
M. J. HUBENY
SELIM W. MCARTHUR
KARL A. MEYER
ALBERT H. MONTGOMERY
OSCAR E. NADEAU
DALLAS B. PHEMISTER
SAMUEL SALINGER
C. F. SAWYER

In addition to an extensive schedule of operative clinics and demonstrations at the hospitals prepared by the sub-committees on ophthalmology and otolaryngology, it is planned to arrange for two evening sessions at the Stevens Hotel at which visiting ophthalmologists and otolaryngologists will present and discuss papers of interest to those who specialize in these particular fields.

In the following pages will be found a preliminary outline of the programs for the scientific sessions to be held each evening in the ballroom of the Stevens Hotel, as prepared by the Executive Committee of the Board of Regents. At the opening session on Monday evening the retiring president, Dr. Eugene H. Pool, of New York, will deliver the presidential address and inaugurate the new officers—Dr. Frederic A. Besley, of Waukegan, president; Dr. Frank W. Lynch, of San Francisco, and Dr. Austin B. Schinbein, of Vancouver, vice-presidents. Also at this session the 1937 class of initiates will be received into Fellowship in the College.

As they so faithfully depict clinical features of major interest to surgeons, the showing of surgical motion picture films will be continued at this

year's session with an enlarged program of both sound and silent pictures to be exhibited daily at headquarters.

Headquarters for the Congress will be established at the Stevens Hotel where the grand ballroom with its large foyers and other meeting-rooms on the second and third floors have been reserved for scientific sessions and conferences.

The Technical Exhibition will be located in the Exhibition Hall in which will be placed the registration and clinic ticket bureaus and the bulletin boards on which the daily clinical program will be posted each afternoon for the following day. Leading manufacturers of surgical instruments, x-ray apparatus, operating room lights, hospital apparatus and supplies of all kinds, ligatures, dressings, pharmaceuticals and publishers of medical books will be represented.

AFTERNOON SESSIONS

A series of five conferences to be held at headquarters has been planned for the afternoons of Tuesday, Wednesday, Thursday and Friday.

On Tuesday afternoon, under the auspices of the Committee on the Treatment of Malignant Diseases, a cancer symposium will be held, dealing largely with scientific and clinical phases of the cancer problem rather than with organization and administrative problems. An important phase of this conference will be the presentation of five-year cures on cancer that will have been compiled by the Department of Clinical Research from statistics furnished by surgeons, pathologists and radiologists as individuals or as members of hospitals and clinics. Added to the 24,440 five-year cures reported by the College in 1934, the figures to be presented should reach an imposing magnitude.

On Wednesday afternoon there will be two symposia, one devoted to obstetrics and gynecology and one to graduate training for surgery. In the former there will be presented papers dealing with the clinical phases of obstetrical and gynecological work which will be of interest not only to those who confine their work to these special fields but also to those whose general work leads them into these fields. Leaders in these specialties have expressed an interest in this symposium that insures its educational value.

The symposium on graduate training for surgery will be devoted to a discussion in which representatives of several interested organizations will participate. As this subject is closely related to the requirements for fellowship in the College, the program will be of particular interest to all Fellows. The College has given this subject close study during the past six years. Many other organizations are interested and it is hoped that this conference will afford an opportunity for the pooling of all available information. Following the presentation of papers dealing with various aspects of the subject there will be a general discussion to bring out the viewpoints of the surgeon in the large teaching hospital, the non-teaching hospital and the community or rural hospital. Other interested organizations, the American Medical Association, the American Board on Surgery, the American Surgical Association and others have been invited to present their viewpoints. Supplementing these discussions, the findings of the 1937 survey of hospitals in the United States and Canada by the American College of Surgeons will be presented.

On Thursday afternoon, under the auspices of the Committee on Industrial Medicine and Traumatic Surgery, the symposium on industrial medicine and traumatic surgery will be confined to subjects that are of special interest to those who practice medical service in industry. Naturally, these subjects will include features that are of paramount interest to all surgeons today because of the important role that the treatment of injuries has assumed as a result of our widespread mechanization and the development of hitherto unknown degrees of force. There is a demand made on the surgical profession to develop and perfect methods of handling the more terrific injuries to all parts of the body. It is expected that in this symposium some of these methods will be presented. Reports will be presented of the year's surveys. The interest of surgeons in industry will be maintained through the following afternoon when the symposium will deal with the diagnosis and treatment of fractures.

On Friday afternoon the Committee on Fractures will present a program that previous experience leads us to believe will be of paramount interest to a large proportion of the Fellows attending the Congress. Leaders in this branch of surgical practice will present methods concerning which all who deal at times with fractures will wish to be familiar.

The subjects of industrial medicine and traumatic surgery, cancer and fractures will also be extensively featured in the extensive scientific exhibits at headquarters and in clinics and demonstrations in the Chicago hospitals.

HOSPITAL CONFERENCE

The twentieth annual hospital standardization conference of the College will be held during the first four days of the Clinical Congress. An inter-

esting program is being prepared consisting of formal addresses, papers, panel discussions and demonstrations. Throughout this program a special effort will be made to cover fully the many pertinent problems related to hospital administration. In brief, the four-day program will be arranged as follows:

Monday—At the opening session of the Congress, beginning at 10 a.m., the approved list of hospitals will be officially announced and representatives of various national organizations will discuss various phases of hospital standardization. The afternoon session will be given over to a well-arranged panel discussion on medical staff conferences, concluding with a staged demonstration of a model conference.

Tuesday—At the morning session the various special services of the general hospital will be discussed, including dental service, care of psychiatric patients, occupational therapy, physical therapy, cancer clinics, etc. For the afternoon a series of carefully selected and planned practical demonstrations in Chicago hospitals will be arranged, presenting such problems or phases of hospital work as are of greatest interest to the visiting delegates. A special session will be arranged for the evening for the discussion of the public relations problem of hospitals.

Wednesday—In the morning there will be a joint session with the Association of Medical Record Librarians of America for the discussion of medical record problems. In the afternoon visiting delegates will have an opportunity of attending demonstrations in hospital administration in local hospitals or of attending the special conference on graduate training for surgery at headquarters.

Thursday—The morning and afternoon sessions are to be given over to round table conferences for the discussion of sixteen pertinent practical topics of vital interest to all hospital administrators.

ADVANCE REGISTRATION

The hospitals and medical schools of Chicago afford accommodations for a large number of visiting surgeons, but to insure against overcrowding, attendance at the Congress will be limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories of the hospitals and medical schools to determine their capacity for visitors. It is expected, therefore, that those surgeons who wish to attend the Congress will register in advance.

A registration fee of $5.00 is required of each surgeon attending the annual Clinical Congress, such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters. This card, which is non-transferable, must be presented in order to secure clinic tickets and admission to the evening meetings.

Admittance to clinics and demonstrations will be controlled by means of special clinic tickets, such plan providing an efficient means for the distribution of the visiting surgeons among the several clinics and insuring against overcrowding, as the number of tickets issued for any clinic will be limited to the capacity of the room in which that clinic is given.

PROGRAMS FOR EVENING MEETINGS

Presidential Meeting and Convocation—Monday, 8:00 P.M.—Ballroom, Stevens Hotel

Address of Welcome. VERNON C. DAVID, M.D., Chicago, Chairman, Committee on Arrangements.
Introduction of Foreign Guests.
Address of the Retiring President. EUGENE H. POOL, M.D., New York.
Inauguration of Officers.
Conferring of Fellowships. FREDERIC A. BESLEY, M.D., Waukegan, Illinois.
Conferring of Honorary Fellowships. The President.
Annual Oration on Surgery. J. P. LOCKHART-MUMMERY, M.B., B.Ch., F.R.C.S., London.

Tuesday, Wednesday and Thursday, 8:00 P.M.—Ballroom, Stevens Hotel

Nucleus Pulposus and Lower Back and Sciatic Pains. HOWARD C. NAFFZIGER, M.D., San Francisco.
Symposium on Lymphedema:
The Genesis and Consequences of Lymphedema. CECIL K. DRINKER, M.D., Boston.
Circulatory and Lymphatic Disturbances in the Abdomen. WILLIS D. GATCH, M.D., Indianapolis.
Diverticula of the Intestine. CLAUDE F. DIXON, M.D., Rochester, Minnesota.
Immediate or Delayed Treatment of Acute Cholecystitis (Liver-Shock and Death). HENRY W. CAVE, M.D., New York.
Tuberculosis of the Kidney. FRANK HINMAN, M.D., San Francisco.
Physiological and Pathological Changes in the Urinary Tract during Pregnancy. J. MASON HUNDLEY, JR., M.D., Baltimore.
Acute Pancreatitis. IRVIN ABELL, M.D., Louisville.
Fracture Oration.

Community Health Meeting—Friday, 8:00 P.M.—Ballroom, Stevens Hotel

Detailed program in preparation.

PRELIMINARY CLINICAL PROGRAM

GENERAL SURGERY

Monday Afternoon

CHICAGO MEMORIAL HOSPITAL—*Charles J. Drueck, Sr., George L. Brooks, Otto Saphir* and *George Landau.* Symposium: Carcinoma of the rectum, carcinoma of the colon.

Charles E. Kahlke, George L. Brooks, Otto Saphir and *George Landau.* Symposium: Peptic ulcer.

COOK COUNTY HOSPITAL—*Sumner L. Koch.* Surgery of the hand.

PASSAVANT MEMORIAL HOSPITAL—*Sumner L. Koch, Michael L. Mason* and *Harvey S. Allen.* Surgery of the hand: Dupuytren's contracture, Von Volkmann's contracture, nerve and tendon suture, burn contractures of the hand and plastic repair with skin grafts, chronic tenosynovitis.

ST. ANTHONY DE PADUA HOSPITAL—*R. C. Drury.* Spinal anesthesia.

WOMEN AND CHILDREN'S HOSPITAL—*Clementine Frankowski* and *Helen M. Kostka.* Varicose veins, treatment by injection and by ligation.

Tuesday Morning

AUGUSTANA HOSPITAL—*N. M. Percy.* Operations.

ALBERT MERRITT BILLINGS HOSPITAL—Clinical demonstrations.

Lester R. Dragstedt and staff. Clinical and experimental studies in gastric and duodenal ulcer.

Walter L. Palmer, F. E. Templeton and *Rudolf Schindler.* X-ray and gastroscopic studies of gastric ulcer under medical treatment.

A. Brunschwig. Pancreatoduodenectomy for carcinoma of the head of the pancreas.

H. P. Jenkins. Abdominal wound disruptions and the durability of catgut sutures.

CHICAGO MEMORIAL HOSPITAL—*Charles E. Kahlke.* Stomach surgery.

Charles J. Drueck, Sr. Surgery of the colon and rectum.

COOK COUNTY HOSPITAL—*Karl A. Meyer, R. H. Jaffe, M. J. Hubeny, Aaron Arkin* and *Rudolf Schindler.* Symposium: Surgery of the stomach. Operations.

Dr. Gatewood. Children's surgery.

George G. Davis, Albert H. Montgomery, John Harger, Harry Jackson and *John G. Frost.* Operations.

GARFIELD PARK HOSPITAL—*Edmund Foley, Paul Schmitt, Harold Wait, Samuel Plice, Claude Weldy* and *Fred DeStefano.* Symposium: Gall-bladder disease.

JACKSON PARK HOSPITAL—*Staff.* Symposium: Appendicitis.

A. Bamberger. Surgical aspect.

R. R. Jamieson. Medical aspect.

J. J. Moore. Pathological aspect.

G. M. Lucas. Clinic.

W. Morley Sherin. Gall-bladder surgery.

LUTHERAN DEACONESS HOSPITAL—*John D. Koucky, G. H. Mammen* and *George H. Schroeder.* Operations.

MERCY HOSPITAL—*Staff.* Dry clinic.

C. F. Sawyer and associates. Unusual causes of intestinal obstruction; partial and complete gastrectomy.

M. McGuire and associates. Pelvic appendicitis; obstructive jaundice.

PRESBYTERIAN HOSPITAL—*Kellogg Speed, Albert H. Montgomery, Dr. Gatewood* and associates. Operations.

V. C. David, C. B. Davis and *E. M. Miller.* Dry clinics and symposia.

RAVENSWOOD HOSPITAL—Dry clinic.

P. J. Sarma. Varicose veins; ligation and obliterative treatment.

R. E. Dyer. End-results of gastro-enterostomies, demonstration of cases.

D. B. Pond and *R. F. Greening.* Treatment of osteomyelitis.

J. J. Moore. Tumors of breast.

D. L. Jenkinson. X-ray interpretations.

George deTarnowsky. Exstrophy of bladder.

C. J. Geiger. Ectopic ureter and absence of vagina; cervical carcinomas.

M. W. Field. Obstetric practice by general practitioner.

W. F. Grosvenor. Toxemia in pregnancy.

W. C. Hammond. Endometriosis.

MICHAEL REESE HOSPITAL—*D. C. Straus.* Thyroid operations.

Ralph B. Bettman and *William Tannenbaum.* Gall-bladder surgery.

A. A. Strauss. Gastro-intestinal surgery.

James Patejdl. Operations.

P. Shapiro. Operations.

Staff. Symposium: Gastro-intestinal diseases.

A. A. Strauss. Surgical treatment of peptic ulcer.

S. Strauss. Pre- and postoperative care of the ulcer patient.

James Patejdl. Perforating ulcer, surgical treatment.

Jacob Meyer. Medical care of the ulcer patient.

Staff. Symposium: Carcinoma of the rectum.

A. A. Strauss. Surgical.

S. Strauss. Surgical diathermy; after care and results of surgical diathermy.

M. Appel. Histiocytic variation in cancer tissue.

Gustav Kolisher. History of surgical diathermy.

Otto Saphir. Pathology of the rectum following surgical diathermy.

RESEARCH AND EDUCATIONAL HOSPITAL—*Geza deTakats.* Lumbar sympathectomy operation.

Staff. Symposium: Neurocirculatory diseases.

R. Brunner. The use of neosynephrine in spinal anesthesia.

Paul W. Smith. Mechanisms governing peripheral circulation.

William C. Beck. Selection of cases for sympathectomy; demonstration of sympathectomized patients; evaluation of results; management of lymphedema.

F. K. Hick. Vascular accidents associated with coronary occlusion.

H. C. Lueth. Unusual reactions following the use of nitroglycerine.

Geza deTakats. Treatment of acute arterial occlusion; operability of hypertension; demonstration of cases.

Eunice Roth. Observations on and results of suction and pressure (pavaex therapy).

P. J. Sarma and *H. L. Mishkin*. The treatment of varicose veins and ulcers.
J. T. Reynolds. Amputations in peripheral vascular disease.

ST. ANTHONY DE PADUA HOSPITAL—*Joseph Zabokrtsky*. Operations.

WASHINGTON BOULEVARD HOSPITAL—*Arthur R. Metz*. General surgery and fractures.

WESLEY MEMORIAL HOSPITAL—*R. W. McNealy, Emory Strauser* and *F. L. Hussey*. Gastric surgery.

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL—*Bennett R. Parker*. Thyroid surgery.

COOK COUNTY HOSPITAL—*Edward J. Lewis*. Operations.

JACKSON PARK HOSPITAL—*Harry E. L. Timm*. Operations.

MERCY HOSPITAL—*C. L. Martin*. Symposium: Rectal neoplasms and inflammations.
J. E. Kelley. The hernia problem.

PASSAVANT MEMORIAL HOSPITAL—*J. R. Buchbinder, A. C. Ivy* and *Arthur Byfield*. Symposium on the biliary tract.

MICHAEL REESE HOSPITAL—Dry clinic.
Nathan Crohn. The use and abuse of the injection treatment of hernia; suitable and unsuitable cases, methods.
Leo Zimmerman. Surgical treatment of direct inguinal hernia.
Rudolf Schindler. The use of the gastroscope and its value to the surgeon.
Samuel Goldberg. Pooled human convalescent serum treatment of surgical streptococcus hemolyticus infections.
James Patejdl. Congenital duodenal obstruction in newborn; duodenal diverticuli causing clinical symptoms.
Staff. Dry clinic.
Leo Zimmerman. Diseases of veins.
Philip Shapiro. Recent advances in the treatment of varicose veins.
Bernard Portis. Embolism of the peripheral arteries.
Samuel Perlow. Surgical measures used in the treatment of peripheral circulatory disturbances; differentiation between arterial and arteriolar spasticity as an aid in the selection of cases for sympathetic ganglionectomy.

ST. LUKE'S HOSPITAL—*Geza deTakats, George Soupham, George K. Fenn, Carl Johnson* and *Richard Capps*. Surgery of cardiovascular diseases.

WOMEN AND CHILDREN'S HOSPITAL—Dry clinic: Management of diseases complicating surgery.
Carolyn MacDonald. Syphilis.
Rose Menendian. Endocrine disorders.
Ruth Renter Darrow. Diabetes.

Wednesday Morning

AUGUSTANA HOSPITAL—*A. T. Lundgren, Earl Garside, R. J. E. Oden* and *J. W. Nuzum*. Operations.

CHICAGO MEMORIAL HOSPITAL—*Peter S. Clark, Vance Rawson, George Landau* and *Otto Saphir*. Gall-bladder symposium.
Leo M. Zimmerman and *Richard E. Heller*. Fundamental problems in the surgical treatment of inguinal hernia; modern management of varicose veins.

CHILDREN'S MEMORIAL HOSPITAL—*A. H. Montgomery, J. Ireland, J. Graham, W. Potts, A. Diggs* and *J. Mussil*. Operations and demonstration of cases.

COLUMBUS HOSPITAL—*D. A. Orth* and *E. Nora*. Bone and joint tuberculosis; peritonitis; Rollier treatment.

COOK COUNTY HOSPITAL—*Raymond W. McNealy, Manuel Lichtenstein, Frederick Tice, Richard H. Jaffe* and *M. J. Hubeny*. Symposium: Diseases of the gall bladder.
Raymond W. McNealy, Victor Schrager, George L. Apfelbach, Roger T. Vaughan and *Marshall Davison*. Operations.

EVANSTON HOSPITAL—Symposium: Colon surgery.
L. D. Snorf. Diagnosis.
E. R. Crowder. Roentgenology.
E. L. Benjamin. Pathology.
Frederick Christopher. Surgery.
W. R. Parkes. Prognosis in malignancy.
Staff. Dry clinic.
Marcus Hobart. Operative treatment of low back pain.
James Grier. Common bile duct obstructions.
W. K. Jennings. Prevention of recurrence in femoral hernia operations.

JACKSON PARK HOSPITAL—*Arrie Bamberger*. Pre- and postoperative treatment of surgical cases.
C. C. Clark and *H. Hoyt Cox*. Operations.

LUTHERAN DEACONESS HOSPITAL—*George O. Solem*. Surgical indications in peptic ulcer.

MUNICIPAL TUBERCULOSIS SANITARIUM—*Clement L. Martin*. Anorectal tuberculosis.
Max Thorek. Surgery in tuberculous patients.

PRESBYTERIAN HOSPITAL—*V. C. David, Kellogg Speed, C. B. Davis, Dr. Gatewood, E. M. Miller, A. H. Montgomery* and associates. Operations.

MICHAEL REESE HOSPITAL—*M. L. Parker, Leo Zimmerman* and *Samuel Goldberg*. Operations.
B. Portis. Thyroid surgery.
Samuel Perlow. Peripherovascular surgery.
A. A. Strauss, S. Strauss and *J. Patejdl*. Gastro-intestinal surgery.
Ralph B. Bettman and *William Tannenbaum*. Gall-bladder operations.
Staff. Dry clinic: Surgery of the gall bladder.
Samuel Soskin. The preparation of the liver for surgery.
R. A. Arens. The technique of cholecystography.
A. M. Serby, S. Portis and *G. Lichtenstein*. The evaluation of liver function tests; gall-bladder diet; survey of postoperative results of the gall-bladder group.
Ralph B. Bettman, Leo Zimmerman and *William Tannenbaum*. Motion picture and diagrammatic demonstrations: The technique of cholecystectomy, choledocostomy, choledochogastrostomy or enterostomy.

RESEARCH AND EDUCATIONAL HOSPITAL—*W. H. Cole*. Thyroidectomy; operation for pyloric obstruction.
Staff. Dry clinic: Symposium: Diseases of the thyroid.
W. H. Cole. Pre-operative and postoperative complications.
L. Seed and *R. Brunner*. Blood pressure studies during thyroidectomy.
J. M. Mora. Hepatic damage in hyperthyroidism.
R. W. Keeton. Cardiac complications of hyperthyroidism.
W. H. Cole. Tracheal collapse.
John Howe. The thyroid gland as observed at autopsy in patients with diseases other than hyperthyroidism.
J. H. Bailey. Bacteriological studies in the operating room.
P. J. Sarma and *H. L. Mishkin*. Clinic on varicose veins.

ST. ANTHONY DE PADUA HOSPITAL—*S. E. Donlon* and *H. P. Sullivan*. Operations and demonstration of cases.

ST. LUKE'S HOSPITAL—*H. E. Jones, Will Lyon, William R. Cubbins* and associates. Operations.

U. S. MARINE HOSPITAL—*O. E. Nadeau*. Results in hernia surgery.
E. C. Lutton and *R. W. Flynn*. Spinal anesthesia demonstration.

WESLEY MEMORIAL HOSPITAL—*William Miller*. Review of gall-bladder surgery.

FRANCES E. WILLARD HOSPITAL—*Victor L. Schrager*. Clinic.

WOMEN AND CHILDREN'S HOSPITAL—*Pearl M. Stetler*. Abdominal surgery.

Wednesday Afternoon

COLUMBUS HOSPITAL—*D. A. Orth, J. L. Spivack, C. J. Scheribel* and *E. D. Nora*. Experimental thyrotoxicosis.

MICHAEL REESE HOSPITAL—*Staff*. Symposium.
Samuel Perlow. Paravertebral alcohol injections for the relief of cardiac pain.
Leo Zimmerman and *Otto Saphir*. Benign tumors of the thyroid gland.
Samuel Goldberg. Acute mesenteric lymphadenitis; strangulated hernias in premature infants.
Thomas J. Merar. Rectal complications of lymphogranuloma inguinale.
Casper Epstein. Fractures of the jaws.
M. L. Parker. Carcinoma of the large bowel.

ST. LUKE'S HOSPITAL—*S. W. McArthur* and associates. Bile tract and colon surgery.

WESLEY MEMORIAL HOSPITAL—*Guy S. Van Alstyne*. Abdominal surgery.

FRANCES E. WILLARD HOSPITAL—*Louis F. Plzak*. Clinic.

Thursday Morning

AUGUSTANA HOSPITAL—*N. M. Percy*. Operations.

CHICAGO MEMORIAL HOSPITAL—*Peter S. Clark, Leo M. Zimmerman* and *M. L. Weinstein*. Gall-bladder surgery.

COOK COUNTY HOSPITAL—*Richard H. Jaffe*. Pathological conference.
Karl A. Meyer, George G. Davis, Albert H. Montgomery and *Max Thorek*. Operations.

JACKSON PARK HOSPITAL—*George M. Lucas*. Operations.

LUTHERAN DEACONESS HOSPITAL—*John D. Koucky, G. H. Mammen* and *George H. Schroeder*. Operations.

MERCY HOSPITAL—*L. D. Moorhead*. Symposium: Goiter.

PASSAVANT MEMORIAL HOSPITAL—*Paul Starr*. Symposium: Diseases of the endocrine glands.

PRESBYTERIAN HOSPITAL—*V. C. David, C. B. Davis, William Miller* and associates. Operations.
Kellogg Speed, Dr. Gatewood and *A. H. Montgomery*. Dry clinics and symposia.

MICHAEL REESE HOSPITAL—*A. A. Strauss* and *S. Strauss*. Gastro-intestinal surgery.
D. C. Straus. General surgery.
Staff. Thyroid symposium.
D. C. Straus. Group study and demonstration of thyroid records; surgical management of hyperthyroidism.
S. Soskin. The endocrine disturbance in thyroid disease.
L. N. Katz. Disturbed physiology of the cardiovascular system in thyroid disease.
M. Lev. Some clinical aspects of the heart in hyperthyroidism; medical management of hyperthyroidism.
A. S. Bohning and *L. N. Katz*. The electrocardiogram in thyroid disease.
W. W. Hamburger. Arrhythmias in thyroid disease.
B. Portis. Outpatient clinic management of hyperthyroidism.
B. Portis and *H. Roth*. Treatment of hyperthyroidism complicated by pregnancy and syphilis.
R. Levine. Experimental treatment of hyperthyroidism.

RESEARCH AND EDUCATIONAL HOSPITAL—*C. B. Puestow*. Operations: Choledochostomy; carcinoma of rectum.
Staff. Symposium: Gall-bladder diseases.
C. B. Puestow. The effect of cholecystectomy on pressure in the choledochus; gall-bladder fistulæ.
Edmund Foley. Differential diagnosis between intrahepatic and extrahepatic jaundice.
W. H. Cole. The role of cystic duct obstruction to gall-bladder disease.
A. Hartung. The advantage of combining gastro-intestinal series with cholecystography.

ST. ANTHONY DE PADUA HOSPITAL—*F. B. Olentine*. Operations and demonstration of goiter and abdominal surgery cases.

WESLEY MEMORIAL HOSPITAL—*R. W. McNealy* and associates. Surgery of jaundiced patients.

FRANCES E. WILLARD HOSPITAL—*A. E. Stewart*. Clinic.

WOMEN AND CHILDREN'S HOSPITAL—*Pearl M. Stetler* and *Marie Ortmayer*. Gastro-intestinal clinic; gastroscopic technique.
Alice Conklin. Thyroidectomy.
Esther Rahn. Repair of ventral hernia.

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL—*Bennett R. Parker, Leo M. Zimmerman, Walter S. Priest, Otto Saphir* and *George M. Landau*. Symposium: Thyroid disease.
Frank Wright, Albert Zrunek, Leo M. Zimmerman, M. L. Weinstein and *Otto Saphir*. Symposium: Blood transfusion.

COOK COUNTY HOSPITAL—*Ralph B. Bettman* and *Edward J. Lewis*. Operations.

MICHAEL REESE HOSPITAL—Symposium: Gastro-intestinal surgery.
Leon Bloch. The medical treatment of ulcerative colitis.
A. A. Strauss. The surgical management of ulcerative colitis.
S. Strauss. The use of ileostomy in ulcerative colitis and carcinoma of the colon.
Otto Saphir. Pathology of ulcerative colitis. Discussion.
R. Arens. X-ray diagnosis of ulcerative colitis and peptic ulcer. Discussion.
A. A. Strauss and *H. F. Binswanger*. Medical and surgical treatment of terminal ileitis.

RESEARCH AND EDUCATIONAL HOSPITAL—Symposium: Diseases of the gastro-intestinal tract.
George Milles and *W. H. Cole*. Pathology of carcinoma of stomach; total gastrectomy.
C. L. Birch. Anemia associated with total gastrectomy.
M. H. Streicher. Diagnosis of carcinoma of the rectum.
C. B. Puestow. Surgical treatment of carcinoma of the rectum.
Bernard Portis. Surgical treatment of complicated duodenal ulcers.

F. L. McMillan. Regional ileitis.
J. L. Spivack. Tubovalvular stoma with particular reference to gastrostomy.
H. O. Wernicke. The injection treatment of herniæ.

ST. ANTHONY DE PADUA HOSPITAL—*W. H. Bradley.* Operations.

WESLEY MEMORIAL HOSPITAL—*E. B. Perry* and *H. E. E. Barnard.* Abdominal surgery.

FRANCES E. WILLARD HOSPITAL—*Otis M. Walter.* Clinic.

WOMEN AND CHILDREN'S HOSPITAL—*Emelia Giryotas.* Cholecystectomy.

Friday Morning

ALBERT MERRITT BILLINGS HOSPITAL—Presentation on surgery and the circulation.
H. Livingstone. Anesthesia and the circulation.
N. Roome, H. Wilson, H. N. Harkins and *D. B. Phemister.* Studies in causes and treatment of surgical shock.
W. E. Adams. Intrathoracic operation and the circulation.

COLUMBUS HOSPITAL—*M. J. Seifert.* Gastro-intestinal surgery.

COOK COUNTY HOSPITAL—*Dr. Gatewood.* Children's surgery.
Ralph C. Sullivan, Vernon C. David, Harry Jackson and *Frank J. Jirka.* Operations.

JACKSON PARK HOSPITAL—*Arrie Bamberger, H. Hoyt Cox* and *C. Clark.* Operations.

LUTHERAN DEACONESS HOSPITAL—*John D. Koucky, G. H. Mammen* and *George H. Schroeder.* Operations.
George O. Solem. Surgical indications in peptic ulcer.

PASSAVANT MEMORIAL HOSPITAL—*Samuel J. Fogelson.* Experimental surgical problems.

PRESBYTERIAN HOSPITAL—*V. C. David, Kellogg Speed, C. B. Davis, Dr. Gatewood, William Miller* and *A. H. Montgomery.* Operations.

MICHAEL REESE HOSPITAL—*J. Patejdl, P. Shapiro, R. Crawford, B. Portis, S. Goldberg, M. L. Parker* and *Leo Zimmerman.* Operations.

RESEARCH AND EDUCATIONAL HOSPITAL—*R. B. Malcolm.* Operative clinic: Neck dissection; carcinoma of breast; surgical pathology of breast tumors.
Staff. Dry clinic.
T. J. Wachowski. X-ray treatment of carcinoma of the breast.
Arrie Bamberger. Ewing tumor with case report.
S. R. Rosenthal. The toxin and antitoxin of burns.
C. H. Puestow. Vitamin ointments in the healing of burns.
W. H. Cole. Acute pancreatitis.

ST. ANTHONY DE PADUA HOSPITAL—*J. J. Sprafka.* Abdominal surgery and demonstration of cases.

ST. ELIZABETH'S HOSPITAL—*E. D. Kalzelage.* Thyroid disease.

ST. LUKE'S HOSPITAL—*E. W. Hirsch, E. Jenkinson* and staff members. Staff clinic.

WESLEY MEMORIAL HOSPITAL—*Earl Latimer.* Unusual breast tumors.

Friday Afternoon

COOK COUNTY HOSPITAL—*J. G. Frost.* Operations.
Sumner L. Koch. Surgery of the hand.
E. H. Warszewski. Operations.

JACKSON PARK HOSPITAL—*Harry E. L. Timm.* Operations.

ST. ELIZABETH'S HOSPITAL—*J. K. Narat.* Pre- and post-operative intravenous administration of fat emulsion.

Days to be Announced

COOK COUNTY HOSPITAL—*Victor L. Schrager.* Symposium: Appendicitis.
Sumner L. Koch. Symposium: Hand infections.
Harry Jackson. Symposium: Skull fractures.
Edwin M. Miller. Symposium: Children's surgery.
Frederick G. Dyas. Symposium: Peritonitis.
Marshall Davison., Symposium: Diseases of the thyroid gland.
Vernon C. David.' Symposium: Surgery of the large bowel.

HENROTIN HOSPITAL—*John A. Graham.* Demonstration clinic.
Karl A. Meyer and *Peter Rosi.* Dry clinic.

ORTHOPEDIC SURGERY

Monday Afternoon

RESEARCH AND EDUCATIONAL HOSPITAL—*H. B. Thomas, F. W. Hark* and *C. N. Lambert.* Symposium: Tenodesis. Operations and demonstration of cases; shelving of congenital dislocated hip; demonstration of patients with closed reduction, open reduction and shelving of congenital dislocation.

Tuesday Morning

CHILDREN'S MEMORIAL HOSPITAL—*F. Chandler, F. Seidler, C. Pease* and *J. Norcross.* Operations and demonstration of cases.

COOK COUNTY HOSPITAL—*Arthur Conley.* Operations and symposium with demonstration of cases; blind pegging of hip for fracture of neck of femur, using Kirschner wire and Smith-Petersen nail; problems in diagnosis of bone tumors; painful back in medicolegal cases; persistent dizziness following head injuries; fractures in and about the ankle.
Marcus H. Hobart. Operations: removal of internal semilunar cartilage. Demonstration of cases: recurrent dislocations of the shoulder, internal derangement of the knee joint, spinal fusions and low back pain, acquired dislocations of the hip following scarlet fever, syndactylism.

PRESBYTERIAN HOSPITAL—*E. J. Berkheiser.* Dry clinic and demonstration of cases.

MICHAEL REESE HOSPITAL—*Philip Lewin, Daniel Levinthal, Charles Pease, F. Glassman, Sidney Sideman, Jerome G. Finder* and *I. Wolin.* Operations.

Tuesday Afternoon

WESLEY MEMORIAL HOSPITAL—*F. M. Jansey, H. Kelikian* and *O. H. Horrall.* Bone and joint surgery.

Wednesday Morning

LUTHERAN DEACONESS HOSPITAL—*Emil Vrtiak.* Indications for surgical treatment of arthritis.

MUNICIPAL TUBERCULOSIS SANITARIUM—*E. J. Berkheiser.* Bone tuberculosis.

VETERANS ADMINISTRATION FACILITY—*S. K. Livingston.* Operations.

WESLEY MEMORIAL HOSPITAL—*Philip H. Kreuscher* and associates. Bone and joint surgery; knee injuries.

Wednesday Afternoon

EVANSTON HOSPITAL—*J. L. Porter* and *R. C. Lonergan.* Low back disorders.

MERCY HOSPITAL—*J. D. Claridge* and associates. Problems in orthopedic and traumatic surgery.

PRESBYTERIAN HOSPITAL—*E. J. Berkheiser, Kellogg Speed* and *D. Rider.* Operations.

MICHAEL REESE HOSPITAL—*Philip Lewin.* Fracture problems; new approach for arthrodesis of knee joint; discussion of bone tumors; motion picture demonstration of manipulative surgery.

Sidney Sideman. Rice bodies in tendon sheath of the hand; Hoke stabilization of the foot; spastic paralysis; roentgenologic library of the hip joint; fusion operation in tuberculosis of the knee joint; bunion operation; multiple cartilaginous exostosis.

Daniel H. Levinthal and *Irving Wolin.* Tendon transplantation in poliomyelitis, spastic paralysis, recurrent dislocation of shoulder, flat feet; demonstration of arthroplasties of the knee, hip and elbow; knee joint surgery.

Charles Pease. Acute transverse atrophy of bone; traumatic rupture of intervertebral disc; reduction of compression fracture of spine; osteochondromatosis of the elbows.

Jerome G. Finder. Chondromyxosarcoma, two cases; flexorplasty of the thumb for paralytic opponens pollicis; osteochondroma of the tibia; McBride bunion plasty; unusual bone tumor (?) of femur; Key operation for soft corns; spastic paralysis—bilateral adductor tenotomy and obturator nerve neurectomy, case with unusual deformities.

Frank Glassman. Fracture and dislocation of shoulder; supracondylar fracture of the humerus; fracture of the neck of the femur; complete fracture of the tibia and fibula; removal of the head of the radius, three cases; osteoma of the femur; demonstration of various types of fractures and treatment.

ST. ANTHONY DE PADUA HOSPITAL—*Thomas Dwyer.* New bone biopsy trephine, pathological specimens.

VETERANS ADMINISTRATION FACILITY—*S. K. Livingston.* Bone tumors.

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL—Presentation on bone and joint surgery.

E. L. Compere. Leg lengthening operation, technique and results; spinal fusion in the correction of scoliosis.

C. H. Hatcher. The pathology and treatment of tuberculous arthritis; studies in the rate of skeletal growth and equalization of limb length.

H. N. Harkins. Bone graft operations for ununited fracture.

P. C. Bucy and *R. B. Cloward.* Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis.

C. B. Huggins. Studies in the distribution of red bone marrow and the reticuloendothelial system in the skeleton.

COOK COUNTY HOSPITAL—*Daniel H. Levinthal.* Bone graft surgery for nonunion, stabilization and benign bone tumors. Motion picture demonstration: Surgical treatment of spastic paralysis; surgical treatment of residual paralysis following poliomyelitis.

Philip H. Kreuscher. Nicola operation; semilunar cartilage derangement; spinal grafts; new operation for hip fusion; new operation for knee fusion.

Philip Lewin. Tunnel skin graft over os calcis; spondylolisthesis; stabilization of paralytic varus foot; arthrodesis of ankle joint; hallux varus; tuberculous spine, fusion; infantile paralysis; low back pain with "sciatica."

Frank G. Murphy. Skin grafts for old wounds of leg; unusual bone tumors; fracture into ankle joint; malunion of Colles' fracture; tuberculosis of cuneiform bone; scar contracture of forearm, skin graft.

MICHAEL REESE HOSPITAL—*Philip Lewin, Daniel Levinthal, Charles Pease, F. Glassman, I. Wolin, Sidney Sideman* and *Jerome G. Finder.* Operations.

VETERANS ADMINISTRATION FACILITY—*S. K. Livingston.* Maggot treatment of osteomyelitis.

Thursday Afternoon

COOK COUNTY HOSPITAL—*E. J. Berkheiser.* Operations and demonstration of cases—spondylolisthesis, anterior poliomyelitis, arthrodesis and tendon transplantation.

PRESBYTERIAN HOSPITAL—*E. J. Berkheiser* and *D. Rider.* Operations.

RESEARCH AND EDUCATIONAL HOSPITAL—*H. B. Thomas, F. W. Hark* and *C. N. Lambert.* Operation: Shelving of a congenital dislocated hip. Demonstration of patients with closed reduction, open reduction, and shelving of congenital dislocation.

ST. LUKE'S HOSPITAL—*E. W. Ryerson* and associates. Demonstration of cases.

Friday Morning

LUTHERAN DEACONESS HOSPITAL—*Emil Vrtiak.* Indications for surgical treatment of arthritis.

PRESBYTERIAN HOSPITAL—*E. J. Berkheiser, Kellogg Speed* and *D. Rider.* Operations.

FRACTURES AND TRAUMATIC SURGERY

Monday Afternoon

COOK COUNTY HOSPITAL—*William R. Cubbins* and associates. Operative fractures.

JACKSON PARK HOSPITAL—*S. W. M. Robinson, C. W. Hennan* and *M. J. Mills.* Traumatic surgery.

ST. ANTHONY DE PADUA HOSPITAL—*F. W. Slobe.* Fractures; special phases of traumatic surgery.

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL—*Arthur H. Conley* and *S. Perry Rogers.* Symposium: Blind pegging of fractures of the femur.

Fred Miller, T. C. Browning, Emile Duval and *George M. Landau.* Fracture of both bones of lower leg.

COOK COUNTY HOSPITAL—*William R. Cubbins* and associates. Ward walk.

WASHINGTON BOULEVARD HOSPITAL—*Arthur R. Metz.* General surgery and fractures.

Tuesday Afternoon

CHICAGO MEMORIAL HOSPITAL—*C. R. G. Forrester, Horace Stimson* and *A. H. Mason.* Symposium: Fractures; nerve repair.

COOK COUNTY HOSPITAL—*Sumner L. Koch* and associate. Tendon and nerve suturing of the hand; hand infections.

VETERANS ADMINISTRATION FACILITY—*S. K. Livingston.* Dry clinic.

Wednesday Morning

COOK COUNTY HOSPITAL—*William R. Cubbins* and associates. Ward walk.
Frederick Dyas. Ward walk (female).

EVANSTON HOSPITAL—*Dwight Clark.* Fractures about the knee joint.

Wednesday Afternoon

COOK COUNTY HOSPITAL—*William R. Cubbins, James J. Callahan, Carlo S. Scuderi, Frederick Dyas* and *George L. Apfelbach.* Symposium: Knee joint injuries.

PASSAVANT MEMORIAL HOSPITAL—*Paul B. Magnuson* and *James K. Stack.* Symposium on fractures.

Thursday Morning

COOK COUNTY HOSPITAL—*William R. Cubbins* and associates. Ward walk.

GARFIELD PARK HOSPITAL—*J. J. Callahan, H. N. Wait* and *Milton Schmitt.* Demonstration clinic.

JACKSON PARK HOSPITAL—*Arrie Bamberger.* Demonstration clinic.

U. S. MARINE HOSPITAL—*Horace P. Stimson.* Ununited fractures with osteomyelitis.
E. C. Lutton and *R. W. Flynn.* Skeletal traction and countertraction in treatment of fractures.

FRANCES E. WILLARD HOSPITAL—*James A. Valentine.* Clinic.

Thursday Afternoon

CHICAGO MEMORIAL HOSPITAL—*Arthur H. Conley* and *S. Perry Rogers.* Blind pegging of fractures of the femur.
Fred Miller, T. C. Browning, Emile Duval and *George M. Landau.* Fracture of both bones of the lower leg.

COOK COUNTY HOSPITAL—*William R. Cubbins* and associates. Operative fractures.
George L. Apfelbach. Ward walk (female).

JACKSON PARK HOSPITAL—*S. W. M. Robinson, C. W. Hennan* and *M. J. Mills.* Traumatic surgery.

FRANCES E. WILLARD HOSPITAL—*Fred Carls.* Clinic.

WOMEN AND CHILDREN'S HOSPITAL—*Armina Hill.* Minor injuries.
Mary E. Williams. Fractures; dislocations.

Friday Morning

CHICAGO MEMORIAL HOSPITAL—*C. R. G. Forrester, Horace Stimson* and *A. H. Mason.* Fractures; nerve repair.

COOK COUNTY HOSPITAL—*William R. Cubbins* and associates. Follow-up clinic; demonstration of cases.

Friday Afternoon

COLUMBUS HOSPITAL—*F. Mueller.* Fractures.
W. L. Beecher. Traumatic surgery.

COOK COUNTY HOSPITAL—*James J. Callahan* and *Carlo S. Scuderi.* Cadaver demonstrations.

Days to be Announced

COOK COUNTY HOSPITAL—*Dr. Gatewood.* Symposium: Fractures in children.

HENROTIN HOSPITAL—*Arthur R. Conley.* Demonstration clinic.

GENITO-URINARY SURGERY

Monday Afternoon

COLUMBUS HOSPITAL—*E. Nora, William Gehl, Frank L. Chenoweth, H. E. Davis* and *I. F. Volini.* Resectoscope for bladder carcinoma.

Tuesday Morning

PASSAVANT MEMORIAL HOSPITAL—*L. L. Veseen, V. L. Lespinasse, Harry Culver* and *Fred Lieberthal.* Symposium: Tuberculosis of the urinary tract.

PRESBYTERIAN HOSPITAL—*Herman L. Kretschmer, Robert Herbst* and associates. Operations.

MICHAEL REESE HOSPITAL—*I. Koll, J. Eisenstaedt, H. Rolnick, I. Shapiro, J. Grove, F. Lieberthal* and *A. E. Jones.* Symposium: Carcinoma of the urinary bladder.

WESLEY MEMORIAL HOSPITAL—*V. D. Lespinasse* and associates. Clinic.

WOMEN AND CHILDREN'S HOSPITAL—*Marie Ortmayer* and *Pearl M. Steller.* Clinic.

Tuesday Afternoon

RESEARCH AND EDUCATIONAL HOSPITAL—*C. M. McKenna, R. D. Herrold* and staff. Operations and demonstrations: Experimental and clinical studies on various types of urinary antiseptics; anomalies with special reference to undescended testicle and hypospadias.

ST. ANTHONY DE PADUA HOSPITAL—*O. J. Jirsa.* Prostatic management; carcinoma of bladder; pyelography.

Wednesday Morning

CHICAGO MEMORIAL HOSPITAL—*J. William Parker* and *John P. O'Neil.* Operations.

COLUMBUS HOSPITAL—*William Gehl.* Symposium: Prostatic hypertrophy, resection, enucleation.

COOK COUNTY HOSPITAL—*Harry Culver, L. L. Veseen, Charles McKenna* and *Harry Rolnick.* Operations.

GARFIELD PARK HOSPITAL—*Vincent J. O'Conor, C. C. Saelhof* and associates. More recent advances in infections in the urinary tract.

MERCY HOSPITAL—*H. E. Landes.* Symposium: Transurethral resection.
J. E. Laibe and associates. Kidney anomalies; treatment of neoplasms of the urinary tract.

MUNICIPAL TUBERCULOSIS SANITARIUM—*Dorrin Rudnick.* Tuberculosis of the genito-urinary tract.

PRESBYTERIAN HOSPITAL—*Herman L. Kretschmer, Robert Herbst* and associates. Operations.

MICHAEL REESE HOSPITAL—*I. Koll, J. Eisenstaedt, H. Rolnick, I. Shapiro, J. Grove, F. Lieberthal* and *A. E. Jones.* Operations.

WASHINGTON BOULEVARD HOSPITAL—*Vincent J. O'Conor.* Dry clinic.

Wednesday Afternoon

CHICAGO MEMORIAL HOSPITAL—*J. William Parker, John P. O'Neil, E. J. Stieglitz, D. G. Brunjes, Otto Saphir* and *George M. Landau.* Symposium: Kidney infections.
M. L. Weinstein, J. William Parker and *John P. O'Neil.* Transurethral resection of the prostate.
R. A. Melendy, J. William Parker, John P. O'Neil and *Otto Saphir.* Tuberculosis of the genito-urinary tract in males.

EVANSTON HOSPITAL—*J. I. Farrell.* Undescended testicles.

ST. ELIZABETH'S HOSPITAL—*T. G. McDougall.* Carcinoma of the bladder.

Thursday Morning

CHILDREN'S MEMORIAL HOSPITAL—*Herman L. Kretschmer* and *K. Barber.* Operations and demonstration of cases.

COOK COUNTY HOSPITAL—*Harry Culver* and *Charles McKenna.* Symposium: Chronic bladder neck obstructions in the male.

JACKSON PARK HOSPITAL—*William Yonker.* Transurethral prostatic resection compared to other types of prostatic surgery.

PRESBYTERIAN HOSPITAL—*Herman L. Kretschmer, Robert Herbst* and associates. Operations.

MICHAEL REESE HOSPITAL—*I. Koll, J. Eisenstaedt, H. Rolnick, I. Shapiro, J. Grove, F. Lieberthal* and *A. E. Jones.* Operations.

ST. LUKE'S HOSPITAL—*L. W. Schmidt* and associates. Dry clinic.

VETERANS ADMINISTRATION FACILITY—*T. G. McDougall.* Carcinoma of the bladder.

WESLEY MEMORIAL HOSPITAL—*V. D. Lespinasse* and associates. Clinic.

Friday Morning

PRESBYTERIAN HOSPITAL—*Herman L. Kretschmer, Robert Herbst* and associates. Dry clinic.

VETERANS ADMINISTRATION FACILITY—*T. G. McDougall.* Perineal prostatectomy.

Days to be Announced

COOK COUNTY HOSPITAL—*L. L. Veseen* and *Harry Rolnick.* Symposium: Pyogenic infections of the upper urinary tract.

HENROTIN HOSPITAL—*Dorrin Rudnick.* Kidney complications in women.

NEUROSURGERY

Monday Afternoon

COOK COUNTY HOSPITAL—*H. C. Voris* and *J. J. Kearns.* Intracranial injury—demonstration of pathology, physiology, management, surgical interference, sequelæ, complications.

Tuesday Morning

RESEARCH AND EDUCATIONAL HOSPITAL—*Geza deTakats.* Operation: Lumbar sympathectomy.

Staff. Symposium: Neurocirculatory diseases.

R. Brunner. The use of neosynephrine in spinal anesthesia.

Paul W. Smith. Mechanisms governing peripheral circulation.

William C. Beck. Selection of cases for sympathectomy; demonstration of sympathectomized patients; evaluation of results; the management of lymphedema.

F. K. Hick. Vascular accidents associated with coronary occlusion.

H. C. Lueth. Unusual reactions following the use of nitroglycerine.

Geza deTakats. The treatment of acute arterial occlusion; operability of hypertension, demonstration of cases.

Eunice Roth. Observations on and results of suction and pressure (pavaex) therapy.

H. L. Mishkin and *P. J. Sarma.* The treatment of varicose veins and ulcers.

J. T. Reynolds. Amputations in peripheral vascular disease.

Tuesday Afternoon

MERCY HOSPITAL—*C. F. Schaub* and *H. C. Voris.* Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; discussion of diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

PRESBYTERIAN HOSPITAL—*A. Verbrugghen.* Dry clinic and demonstration.

Wednesday Morning

RESEARCH AND EDUCATIONAL HOSPITAL—*Eric Oldberg.* Operations and demonstration of cases.

Wednesday Afternoon

COOK COUNTY HOSPITAL—*A. Verbrugghen.* Surgical paraplegia—etiology, pathology, classification, physiology, treatment, prognosis.

PRESBYTERIAN HOSPITAL—*A. Verbrugghen.* Operations.

Thursday Morning

ALBERT MERRITT BILLINGS HOSPITAL—*P. C. Bucy* and *R. B. Cloward.* Spinal extradural cyst and its relation to kyphosis dorsalis juvenilis.

RESEARCH AND EDUCATIONAL HOSPITAL—*Eric Oldberg.* Operations and demonstration of cases.

Thursday Afternoon

MERCY HOSPITAL—*H. C. Voris* and associates. Symposium: Management of cerebral gliomas.

H. C. Voris and *H. E. Landes.* Demonstration of choroid plexus resection in hydrocephalus; cytometric studies in neurological lesions.

C. F. Schaub and *H. C. Voris.* Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; discussion of diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

PRESBYTERIAN HOSPITAL—*A. Verbrugghen.* Operations.

MICHAEL REESE HOSPITAL—*Staff.* Symposium: Intracranial suppuration.

Roy Grinker. Neurological aspects of intracranial suppuration.

A. Verbrugghen. Surgical aspects of brain abscess.

Friday Afternoon

PASSAVANT MEMORIAL HOSPITAL—*Loyal Davis* and *John Martin.* Neurological surgery: Presentation emphasizing diagnosis and treatment.

PRESBYTERIAN HOSPITAL—*A. Verbrugghen.* Operations.

THORACIC SURGERY

Monday Afternoon

ST. LUKE'S HOSPITAL—*Willard Van Hazel.* Demonstration clinic.
Paul H. Holinger. Surgery of bronchii.

Tuesday Morning

COLUMBUS HOSPITAL—*R. M. Davison, C. Volini, M. Joannides, D. Orth* and *G. Mueller.* Symposium in tuberculosis: Thoracic surgery; pneumothorax treatment including climatotherapy.

COOK COUNTY HOSPITAL—*John B. O'Donoghue* and *Robert Lee.* Treatment of empyema; ward walk and presentation of cases.

RESEARCH AND EDUCATIONAL HOSPITAL—*Willard Van Hazel.* Operations with demonstration of cases.

VETERANS ADMINISTRATION FACILITY—*Jerome R. Head.* New type of thoracoplasty; chest surgery.

Tuesday Afternoon

COOK COUNTY HOSPITAL—*Ralph B. Bettman.* Operations.

PRESBYTERIAN HOSPITAL—*John Dorsey.* Dry clinic and demonstration.

RESEARCH AND EDUCATIONAL HOSPITAL—*Willard Van Hazel* and staff. Symposium: Bronchogenic carcinoma.
S. Levinson. Pathology.
Adolph Hartung. Roentgenological diagnosis.
Paul H. Holinger. Bronchogenic aspects.
Willard Van Hazel. Surgical consideration; demonstration of cases and specimens; surgical treatment of mediastinal tumors.
M. Joannides. Collapse therapy of pulmonary tuberculosis.
T. J. Wachowski. Roentgenological consideration of mediastinal tumors.

Wednesday Morning

EVANSTON HOSPITAL—*Jerome R. Head.* Indications for lobectomy.

MUNICIPAL TUBERCULOSIS SANITARIUM—*Richard Davison.* Thoracoplasty.

Wednesday Afternoon

MUNICIPAL TUBERCULOSIS SANITARIUM—*M. Joannides.* Phrenic surgery; intrapleural pneumolysis.

PRESBYTERIAN HOSPITAL—*John Dorsey.* Operations.

Thursday Morning

MUNICIPAL TUBERCULOSIS SANITARIUM—*Richard Davison.* Thoracoplasty; pneumolysis.

Thursday Afternoon

COOK COUNTY HOSPITAL—*Ralph B. Bettman.* Operations.

PRESBYTERIAN HOSPITAL—*John Dorsey.* Operations.

MICHAEL REESE HOSPITAL—*Ralph B. Bettman* and *William Tannenbaum.* Thoracic surgery.

Friday Morning

MICHAEL REESE HOSPITAL—*Ralph B. Bettman* and *William Tannenbaum.* Thoracoplasty operation.
Max Biesenthal. Surgery of pulmonary tuberculosis.
Max Biesenthal and *Ralph B. Bettman.* Technique of various operations used for pulmonary tuberculosis: Artificial pneumothorax, pneumolysis, thoracoplasty; motion picture and diagrammatic demonstrations.
Ralph B. Bettman. Treatment of empyema; injuries of the chest; presentation of cases; motion picture and diagrammatic demonstrations.

WOMEN AND CHILDREN'S HOSPITAL—*Helen Hayden, Emelia Giryotas, Margaret Austin* and *Nora B. Brandenburg.* Bronchoscopy in relation to asthma and allied pulmonary conditions; lipiodol injection.

Friday Afternoon

COOK COUNTY HOSPITAL—*John B. O'Donoghue, Frederick Tice, Richard Jaffe, M. J. Hubeny, S. H. Rosenblum* and *A. J. Hruby.* Symposium: Pulmonary tuberculosis.
John B. O'Donoghue. Operations.

PRESBYTERIAN HOSPITAL—*John Dorsey.* Operations.

GYNECOLOGY

Monday Afternoon

COOK COUNTY HOSPITAL—*Frederick H. Falls.* Operations.

WOMEN AND CHILDREN'S HOSPITAL—*Annie E. Blount.* Operations.

Tuesday Morning

COOK COUNTY HOSPITAL—*Carey Culbertson* and *A. E. Kanter.* Operations.

PRESBYTERIAN HOSPITAL—*N. S. Heaney, Carey Culbertson, A. E. Kanter, E. D. Allen* and *H. Boysen.* Operations.

MICHAEL REESE HOSPITAL—*J. L. Baer, J. E. Lackner, William Rubovits, I. F. Stein* and *Ralph Reis.* Operations.

ST. LUKE'S HOSPITAL—*H. O. Jones* and associates. Clinic.

WESLEY MEMORIAL HOSPITAL—*Mark Goldstine* and associates. Uterine bleeding.

WOMEN AND CHILDREN'S HOSPITAL—*Mary Edith Williams.* Removal of abdominal and pelvic tumors.
Otillie Zelezny. Electrocoagulation of the cervix uteri.

Tuesday Afternoon

COOK COUNTY HOSPITAL—*J. P. Greenhill.* Operations.

WOMEN AND CHILDREN'S HOSPITAL—*Eloise Parsons.* Vaginal hysterectomy; vaginal sterilization; ligation of tubes per vaginal route.

Wednesday Morning

COOK COUNTY HOSPITAL—*C. W. Barrett.* Operations.

PASSAVANT MEMORIAL HOSPITAL—*George Gardner* and *Arthur H. Curtis.* Gynecological pathology—demonstration and conference.

PRESBYTERIAN HOSPITAL—*N. S. Heaney, Carey Culbertson, A. E. Kanter, E. D. Allen* and *H. Boysen.* Demonstration of cases.

MICHAEL REESE HOSPITAL—Dry clinic.
Joseph L. Baer. Shifting trends in the treatment of prolapse of the uterus.
Julius E. Lackner. Recent investigations in the action of progesterone.

William H. Rubovits. Postoperative vaginal antisepsis.
Irving F. Stein. Evaluation of the "safe period."
Ralph A. Reis. Mammography.
Lester E. Frankenthal, Jr. Treatment of vulvovaginitis.
Michael L. Leventhal. The Manchester operation for the cure of cystocele and prolapse.
Henry Buxbaum. The role of spermotoxin in temporary sterility.
A. F. Lash. Early diagnosis of carcinoma of the uterus.
E. J. DeCosta. The use of progesterone in the prevention of habitual abortion.
Alfred J. Kobak. Maternal mortality in Chicago.
Herman Strauss. Routine palpation of the ureters during hysterectomy.

Wednesday Afternoon

CHICAGO MEMORIAL HOSPITAL—*Paul M. Cliver, Julia C. Strawn, Harry L. Meyers, Beatrice E. Tucker* and *Walter Wiborg.* Plastic repair.

COOK COUNTY HOSPITAL—*W. T. Carlisle.* Operations.

WOMEN AND CHILDREN'S HOSPITAL—*Constance O'Britis.* Operations.

Thursday Morning

CHICAGO MEMORIAL HOSPITAL—*Paul M. Cliver, Julia C. Strawn, Harry L. Meyers, Beatrice E. Tucker* and *Walter Wiborg.* Symposium: The treatment of prolapse of the uterus, cystocele and rectocele at various ages.

COOK COUNTY HOSPITAL—*Egon W. Fischmann.* Operations.

PRESBYTERIAN HOSPITAL—*N. S. Heaney, Carey Culbertson, A. E. Kanter, E. D. Allen* and *H. Boysen.* Operations.

ST. ANTHONY DE PADUA HOSPITAL—*M. A. Weisskopf.* Operations.

WASHINGTON BOULEVARD HOSPITAL—*Paul C. Fox.* Operations and demonstration of cases.

WESLEY MEMORIAL HOSPITAL—*Mark Goldstine* and associates. Vaginal plastics.

Thursday Afternoon

COOK COUNTY HOSPITAL—*Frederick H. Falls.* Operations.

Friday Morning

COOK COUNTY HOSPITAL—*A. E. Kanter* and *Carey Culbertson.* Operations.

PRESBYTERIAN HOSPITAL—*N. S. Heaney, Carey Culbertson, A. E. Kanter, E. D. Allen* and *H. Boysen.* Operations.

MICHAEL REESE HOSPITAL—*J. L. Baer, J. E. Lackner, William Rubovits, I. F. Stein* and *Ralph Reis.* Operations.

Friday Afternoon

COOK COUNTY HOSPITAL—*Carey Culbertson.* Operations.

MERCY HOSPITAL—*H. E. Schmitz* and associates. Symposium on operative gynecology.

RESEARCH AND EDUCATIONAL HOSPITAL—Symposium: Gynecological plastic operations with special reference to the use of local anesthesia.
Frederick H. Falls. Vaginal hysterectomy for procidentia under local anesthesia.
M. J. Summerville. Anterior colporrhaphy and interposition operation under local anesthesia.
William H. Browne. Sturmdorf-Kelly incontinence operation and perineorrhaphy under local anesthesia.

WOMEN AND CHILDREN'S HOSPITAL—*Catherine True.* Abdominal gynecological cases.
Eloise Parsons. Treatment of sterility; treatment of eroded cervix by cautery; lipiodol visualization of uterus and tubes.

Days to be Announced

COOK COUNTY HOSPITAL—*J. P. Greenhill, C. W. Barrett, W. T. Carlisle, Egon W. Fischmann, Frederick H. Falls, A. E. Kanter* and *Carey Culbertson.* Symposium on fibroids.

HENROTIN HOSPITAL—*Edward L. Cornell.* Operations and demonstration of cases.
Channing W. Barrett and *Lee Stone.* Operations and demonstration of cases.

OBSTETRICS

Monday Afternoon

CHICAGO LYING-IN HOSPITAL—*Fred L. Adair* and staff. Motion picture demonstration of cesarean section.

COOK COUNTY HOSPITAL—*A. F. Lash.* Puerperal sepsis; ward walk.

Tuesday Morning

CHICAGO LYING-IN HOSPITAL—*Fred L. Adair, William J. Dieckmann, M. Edward Davis, H. C. Hesseltine* and staff. Cesarean section. Motion picture demonstration of colpocleisis operation.

COOK COUNTY HOSPITAL—*D. S. Hillis.* Treatment of abortion; ward walk.

FRANCES E. WILLARD HOSPITAL—*Ascher H. Goldfine.* Clinic.

Tuesday Afternoon

CHICAGO LYING-IN HOSPITAL—*William J. Dieckmann* and staff. Dry clinic: Eclampsia. Motion picture demonstration of forceps delivery.

COOK COUNTY HOSPITAL—*L. Rudolph* and *J. H. Bloomfield.* Symposium: The toxemias of pregnancy.

ST. ELIZABETH'S HOSPITAL—*J. R. Lavieri.* Cesarean section.

FRANCES E. WILLARD HOSPITAL—*Ascher H. Goldfine.* Clinic.

Wednesday Morning

CHICAGO LYING-IN HOSPITAL—*Fred L. Adair, William J. Dieckmann, M. Edward Davis, H. C. Hesseltine* and staff. Operations and demonstration of cases.

COOK COUNTY HOSPITAL—*J. E. Fitzgerald.* Heart disease in pregnancy; ward walk.

JACKSON PARK HOSPITAL—*Charles F. Greene, Louis H. Stern, W. J. Nixon-Davis, Jr.* and *Norman Zolla.* Treatment of contracted pelves by cesarean section, version and forceps.

RESEARCH AND EDUCATIONAL HOSPITAL—Symposium.
Frederick H. Falls: Eclamptogenic toxemia, low cervica cesarean section under local anesthesia.

W. H. Browne. Progestin in the treatment of abortion.
G. H. Rezek. Modification of the Friedmann reaction.

WESLEY MEMORIAL HOSPITAL—*Charles B. Reed, William B. Serbin* and *G. C. Richardson.* Moving picture demonstration of low forceps, breech extraction with forceps on aftercoming head, spontaneous breech—manual aid.

WOMEN AND CHILDREN'S HOSPITAL—Dry clinic.
Florence Hark. Prenatal care with reference to the baby.
Ruth R. Darrow. Treatment of icterus gravis.
Bertha Van Hoosen. Maternity mortality.

Wednesday Afternoon

CHICAGO LYING-IN HOSPITAL—*H. C. Hesseltine* and staff. Nonconvulsive toxemia of pregnancy. Motion picture demonstration of birth injury.

CHICAGO MEMORIAL HOSPITAL—*James E. Fitzgerald, William F. Hewitt, George N. Schiff* and *Harry Benaron.* Cesarean section.

COOK COUNTY HOSPITAL—*D. S. Hillis, J. H. Bloomfield* and *A. F. Lash.* Symposium: Cesarean section.

RESEARCH AND EDUCATIONAL HOSPITAL—*Frederick H. Falls* and staff. Operations. Symposium: Gynecological tumors.
Frederick H. Falls. Vulva carcinoma, demonstration of cases, vulvectomy under local anesthesia.
R. A. Lifvendahl. Solid tumors of ovary; removal of ovarian cyst.
H. H. Hill. Early carcinoma of cervix.

WOMEN AND CHILDREN'S HOSPITAL—Dry clinic.
Bertha Van Hoosen and *Maude Hall Winnett.* Anesthesia in obstetrics.
Beatrice E. Tucker. Parasacral anesthesia.

Thursday Morning

CHICAGO LYING-IN HOSPITAL—*Fred L. Adair, William J. Dieckmann, M. Edward Davis, H. C. Hesseltine* and staff. Cesarean section. Motion picture demonstration of blood transfusion.

CHICAGO MEMORIAL HOSPITAL—*James E. Fitzgerald, William F. Hewitt, George N. Schiff* and *Harry Benaron.* Indications and technique for cesarean section; nerve block in obstetrics.

COOK COUNTY HOSPITAL—*J. E. Fitzgerald* and *L. Rudolph.* Symposium: Ectopic pregnancy, its diagnosis and treatment.

Thursday Afternoon

CHICAGO LYING-IN HOSPITAL—*M. Edward Davis* and staff. Placenta prævia; abruptio placenta. Motion picture demonstration of postpartum hemorrhage.

COOK COUNTY HOSPITAL—*J. H. Bloomfield* and *D. S. Hillis.* Symposium: Late hemorrhages of pregnancy.

Friday Morning

CHICAGO LYING-IN HOSPITAL—*Fred L. Adair, William J. Dieckmann, M. Edward Davis, H. C. Hesseltine* and staff. Cesarean section. Dry clinic.

COOK COUNTY HOSPITAL—*A. F. Lash.* Toxemias of pregnancy; ward walk.

WESLEY MEMORIAL HOSPITAL—*Charles B. Reed, William B. Serbin* and *G. C. Richardson.* Ablatio placenta; placenta prævia.

WOMEN AND CHILDREN'S HOSPITAL—*Bertha Van Hoosen* and *Maude Hall Winnett.* Surgical cases complicating obstetrics.

Friday Afternoon

CHICAGO LYING-IN HOSPITAL—*Fred L. Adair* and staff. Dry clinic. Motion picture demonstration of episiotomy.

COOK COUNTY HOSPITAL—*L. Rudolph.* Symposium: Prolonged labor; constriction ring dystocia.

TUMORS AND IRRADIATION

Monday Afternoon

ST. ELIZABETH'S HOSPITAL—*J. Brams.* Radium treatment of fractures.

VETERANS ADMINISTRATION FACILITY—*G. R. Allaben.* Regular tumor clinic.

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL—*Isadore Pilot.* Pathology of malignant growths in relation to therapeutic indications.

ST. ELIZABETH'S HOSPITAL—*M. G. Luken.* Sarcoma of the stomach.

VETERANS ADMINISTRATION FACILITY—*A. E. Williams.* Deep x-ray and radium therapy.

Tuesday Afternoon

RAVENSWOOD HOSPITAL—*C. Buswell, J. J. Moore, H. P. Saunders* and *L. E. Schaeffer.* Cancer clinic, presentation of specimens, lantern slides, cases illustrating melanomas of shoulder and jaw.

Wednesday Morning

ALBERT MERRITT BILLINGS HOSPITAL—Presentation on tumor surgery.
A. Brunschwig. Experimental production of tumors and the efficacy of Coley's toxin in the treatment of experimental sarcoma; palliative treatment of pulmonary metastases from malignant tumors; late results in treatment of benign giant-cell tumors of bone.
D. B. Phemister and associates. Studies in the etiology, diagnosis and treatment of bone tumors.
Harwell Wilson. Extraskeletal ossifying tumors.

VETERANS ADMINISTRATION FACILITY—*Max Cutler.* Annual tumor clinic: Presentation of cancer cases, indications, technique and results of radium therapy.
G. R. Allaben. Diagnosis and treatment.

Thursday Morning

COLUMBUS HOSPITAL—*D. A. Orth, M. Hannan* and *H. E. Davis.* Symposium: Breast cancer.

LUTHERAN DEACONESS HOSPITAL—*Isadore Pilot.* Pathology of malignant growths in relation to therapeutic indications.

MERCY HOSPITAL—*W. J. Pickett.* Unusual cases of malignancy.

MICHAEL REESE HOSPITAL—*Max Cutler* and staff. Results of radiation treatment of cancer of mouth, tonsil, pharynx and larynx; presentation of cases. Radiation treatment of cancer of the breast; presentation of cases. Motion pictures illustrating the technique of radium treatment of cancer of the mouth and cancer of the cervix. Transillumination of the breast.

ST. ELIZABETH'S HOSPITAL—*Leo M. Zimmerman.* Mediastinal tumors.

VETERANS ADMINISTRATION FACILITY—*A. E. Williams.* Inspection of deep x-ray and radium therapy unit.

Thursday Afternoon

PASSAVANT MEMORIAL HOSPITAL—*Max Cutler.* The organization of a tumor clinic: Personnel, equipment, records, follow-up.

Staff. Carcinoma of the breast.

John A. Wolfer. Surgical considerations.

James T. Case. Pre- and postoperative x-ray radiation.

L. M. Rosenthal. Radium treatment.

Major Greene. Bronchiogenic tumors of the neck.

John F. Delph and *Earl Barth.* Carcinoma of the larynx, hypopharynx and tonsil.

John Mohardt. A survey of some proposed cancer cures.

Friday Morning

MERCY HOSPITAL—*Henry L. Schmitz* and associates. Symposium: Radiologic therapy of malignancy.

ST. LUKE'S HOSPITAL—*H. E. Mock* and associates. Tumor clinic.

VETERANS ADMINISTRATION FACILITY—*G. R. Allaben.* Regular tumor clinic.

Friday Afternoon

PRESBYTERIAN HOSPITAL—*Carl Apfelbach* and *F. Squire.* Dry clinic and demonstration.

Day to be Announced

HENROTIN HOSPITAL—*Samuel Levinson.* Surgical pathology.

PLASTIC AND FACIOMAXILLARY SURGERY

Tuesday Morning

CHICAGO MEMORIAL HOSPITAL—*Casper M. Epstein.* Symposium: Plastic, including faciomaxillary surgery.

COOK COUNTY HOSPITAL—*Joseph E. Schaefer.* Demonstration of cases showing corrected temporomandibular ankylosis, harelips and cleft palates; pedicle flap and full thickness graft cases; repair of burns, traumatic injuries; plastic repairs of controlled carcinoma cases.

Tuesday Afternoon

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R. Olmsted.* Operations.

Wednesday Afternoon

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R. Olmsted.* Operations.

Thursday Morning

COOK COUNTY HOSPITAL—*Joseph E. Schaefer.* Demonstration of cases showing carcinoma of mouth, lips and face, with colored photographs of lesions before and after radiation.

MICHAEL REESE HOSPITAL—*Casper Epstein.* Oral surgery.

Thursday Afternoon

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R. Olmsted.* Dry clinic and demonstration.

Friday Afternoon

CHILDREN'S MEMORIAL HOSPITAL—*L. W. Schultz.* Dry clinic and demonstration.

PRESBYTERIAN HOSPITAL—*Frederick Moorehead* and *R. Olmsted.* Operations.

ROENTGENOLOGY

Tuesday Morning

LUTHERAN DEACONESS HOSPITAL—*Ralph Willy.* Newer concepts in the treatment of carcinoma.

Tuesday Afternoon

ST. ANTHONY DE PADUA HOSPITAL—*L. S. Tichy.* Silicosis demonstration.

ST. LUKE'S HOSPITAL—*Staff.* X-ray diagnosis.

Wednesday Afternoon

AUGUSTANA HOSPITAL—*David S. Beilen.* Roentgen diagnosis of gastro-intestinal lesions.

ALBERT MERRITT BILLINGS HOSPITAL—*Paul C. Hodges* and associates. X-ray diagnosis.

Thursday Morning

LUTHERAN DEACONESS HOSPITAL—*Ralph Willy.* Newer concepts in the treatment of carcinoma.

RESEARCH AND EDUCATIONAL HOSPITAL—*Adolph Hartung.* Conference on x-ray diagnosis.

Thursday Afternoon

COOK COUNTY HOSPITAL—*Robert F. McNattin.* High voltage therapy of malignancies.

M. J. Hubeny. Roentgenological examination of appendix.

ST. LUKE'S HOSPITAL—*Staff.* X-ray diagnosis.

Friday Afternoon

AUGUSTANA HOSPITAL—*David S. Beilen.* Roentgen diagnosis of lesions of urinary tract.

COOK COUNTY HOSPITAL—*J. Paul Bennett.* Roentgenological examination of the kidneys, ureters and bladder.

Robert F. McNattin. High voltage therapy of malignancies.

Days to be Announced

HENROTIN HOSPITAL—*Arthur R. Hansen.* X-ray demonstration.

WESLEY MEMORIAL HOSPITAL—*Frank L. Hussey.* The interpretation of x-ray findings in obscure gastric and duodenal lesions; the use of x-ray in conjunction with surgery of the large bowel.

PHYSICAL THERAPY

Monday Afternoon

COOK COUNTY HOSPITAL—*Disraeli Kobak.* Discussion of general physical therapy procedures.

Tuesday Morning

COOK COUNTY HOSPITAL—*Disraeli Kobak.* Physical therapy in posttraumatic conditions.

Tuesday Afternoon

COOK COUNTY HOSPITAL—*I. F. Hummon.* Physical therapy in infantile paralysis.

Wednesday Morning

COOK COUNTY HOSPITAL—*Disraeli Kobak.* Physical therapy in postoperative and traumatic infections.

Wednesday Afternoon

COOK COUNTY HOSPITAL—*I. F. Hummon.* Physical therapy in neurosurgical and neurological conditions.

Thursday Morning

COOK COUNTY HOSPITAL—*Disraeli Kobak.* Physical therapy in low back conditions.

Thursday Afternoon

COOK COUNTY HOSPITAL—*I. F. Hummon.* Manipulative treatment in low back conditions.

Friday Morning

COOK COUNTY HOSPITAL—*Disraeli Kobak.* Physical therapy in bursitis.

Friday Afternoon

COOK COUNTY HOSPITAL—*I. F. Hummon.* Physical therapy in the prevention of deformities.

ST. LUKE'S HOSPITAL—*H. E. Mock* and *John S. Coulter.* Reconstructive cases in physical therapy.

OPHTHALMOLOGY

Monday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*A. C. Krause.* Fundus diagnosis.

CHILDREN'S MEMORIAL HOSPITAL—*G. Guibor.* Orthoptics.

COOK COUNTY HOSPITAL—*E. B. Fowler.* Fundus diagnostic clinic.

MERCY HOSPITAL—*C. F. Schaub, F. I. Barnett* and *E. A. Roling.* Fundus clinic.

MICHAEL REESE HOSPITAL—*Philip Halper.* Orthoptics.

RUSH MEDICAL COLLEGE—*Dr. Holmes.* Orthoptics.

Tuesday Morning

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL—*George Guibor.* Orthoptic training; classification of squint. *Sanford R. Gifford.* Concomitant and paralytic squint.

RUSH MEDICAL COLLEGE—*Dr. Wilber.* Histopathology.

Tuesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*C. V. Devney.* Orthoptics.

COLUMBUS HOSPITAL—*M. Goldenburg.* Eye clinic.

COOK COUNTY HOSPITAL—*C. F. Verger.* Medical ophthalmology.

MERCY HOSPITAL—*C. F. Schaub* and *H. C. Voris.* Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; discussion of diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

MICHAEL REESE HOSPITAL—*T. M. Shapira.* Fundus clinic.

RUSH MEDICAL COLLEGE—*Dr. Jacobson.* Fundus clinic.

ST. LUKE'S HOSPITAL—*E. A. Vorisek.* Clinical cases.

Wednesday Morning

COOK COUNTY HOSPITAL—*Sanford R. Gifford.* Retinal detachment.

RUSH MEDICAL COLLEGE—*W. F. Moncreiff.* Cataract.

Wednesday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*S. S. Blankstein.* End-results of retinal detachment operations.

CHILDREN'S MEMORIAL HOSPITAL—*R. C. Gamble* and *E. A. Vorisek.* Diagnostic clinic.

MERCY HOSPITAL—*C. F. Schaub, F. I. Barnett* and *E. A. Roling.* Fundus clinic.

MICHAEL REESE HOSPITAL—*S. J. Meyer* and *D. Snydacker.* Retinal detachment clinic.

ST. LUKE'S HOSPITAL—*J. Walsh.* Clinical cases.

U. S. MARINE HOSPITAL—*Alfred N. Murray.* Eye injuries.

Thursday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*L. Bothman.* Macular disease.

COLUMBUS HOSPITAL—*M. Goldenburg.* Eye clinic.

COOK COUNTY HOSPITAL—*E. B. Fowler.* Fundus clinic.

MERCY HOSPITAL—*C. F. Schaub* and *H. C. Voris.* Neuro-ophthalmology: Presentation of cases with fundi, perimetric field findings; diagnostic problems; presentation and discussion of cases of recurrent papilledema following cranial explorations and decompressions.

MICHAEL REESE HOSPITAL—*Jack Cowan.* Glaucoma clinic.

ST. LUKE'S HOSPITAL—*Frank E. Brawley* and *J. W. Clark.* Clinical cases.

Friday Afternoon

ALBERT MERRITT BILLINGS HOSPITAL—*Dr. McShellman.* Cataract results.

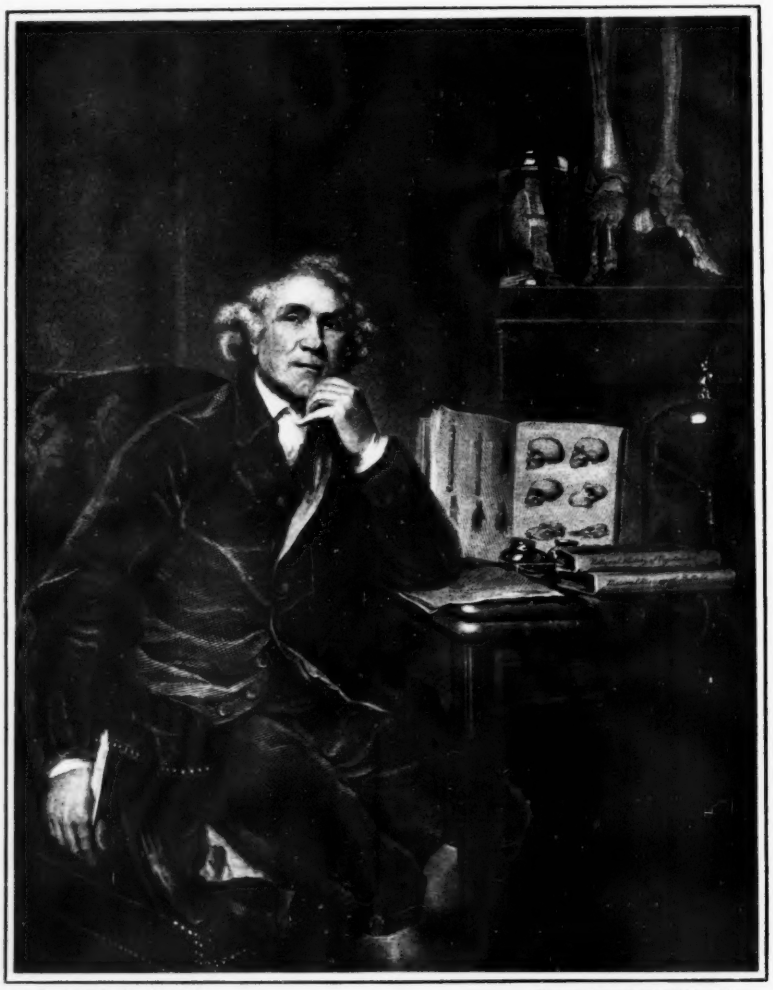
CHILDREN'S MEMORIAL HOSPITAL—*R. O. Riser.* Diagnostic clinic.

RUSH MEDICAL COLLEGE—*E. Selinger.* Medical ophthalmology.

ST. LUKE'S HOSPITAL—*R. C. Gamble.* Clinical cases.

Day to be Announced

HENROTIN HOSPITAL—*George W. Mahoney, E. A. Roling* and *Irving Barnett.* Eye clinic.



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John Hunter

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